TEMPERATURE SELECTOR - MAINTENANCE PRACTICES

1. Removal/Installation Temperature Selector

A. Equipment Required - None.

B. Preparation.

(1) Open ELEC TEMP CONTROL circuit breaker (cabin or flight compartment as required).

C. Remove Temperature Selector (Cabin or flight compartment).

(1) Remove selector knob from shaft on temperature selector (on front of flight engineer's control panel).

(2) Remove plastic edge lighting panel from section containing temperature selector (refer to Chapter 33, LIGHTS).

(3) Open flight engineer's control panel (refer to Chapter 31, INSTRUMENTS).

(4) Disconnect electrical connector from rear of temperature selector. (Cap connector and receptacle. Tag connector for installation.)

(5) Remove mounting nut from selector shaft which secures temperature selector to panel. (Support selector while removing nut.)

(6) Remove temperature selector from back of panel.

D. Install Temperature Selector (Cabin or flight compartment).

(1) Insert temperature selector shaft through mounting hole from back side of panel.

(2) Install mounting nut loosely on shaft on front side of panel..

(3) Position selector so that key is at the 9 o'clock position when viewed from front of panel.

(4) Tighten mounting nut while supporting selector from rear.

(5) Connect electrical connector to rear of temperature selector.

(6) Close flight engineer's control panel (refer to Chapter 31, INSTRUMENTS).

(7) Install plastic edge lighting panel over flight engineer's control panel (refer to Chapter 33, LIGHTS).

(8) Install selector knob on shaft.

(9) Close ELEC TEMP CONTROL circuit breaker.

(10) Perform operational check of air conditioning system (refer to 21-0, Maintenance Practices).

2. Adjustment/Test

A. Equipment Required - Resistance bridge (Leeds and Northrup type 4760 or equivalent.)

B. Test Temperature Selector.

(1) Using resistance bridge, measure resistance between pins A and B of selector. With shaft in full counterclockwise position, as viewed from shaft end, resistance shall be 8122 to 8798 ohms. With shaft in full clockwise position, as viewed from shaft end, resistance shall be a maximum of 100 ohms.

(2) If resistance in either shaft position is not within specified range, replace temperature selector.

3. Inspection/Check

A. Examine exterior of temperature selector for damage to paint or cracks in potting material.

B. Check selector mounting threads and electrical receptacle threads for damage.

C. Check that receptacle mounting screws and the nut which fastens potentiometer to selector frame are tight.

4. Cleaning/Painting

A. Clean temperature selector.

(1) Wipe external surfaces with a clean dry cloth.

(2) Clean interior of electrical receptacle with a soft clean brush.

B. Paint temperature selector.

(1) Mask off electrical receptacle, potentiometer shaft, and identification plate.

(2) Prime with a thin coat of zinc chromate, Specification AMS 3110, to obtain a semitransparent greenish coating.

(3) Allow prime coat to dry 30 minutes at room temperature.

(4) Apply a coat of black lacquer, Specification MIL-L-6805.

(5) Allow to dry 45 minutes at room temperature.

TEMPERATURE SENSORS - MAINTENANCE PRACTICES

1. Removal/Installation Temperature Sensors

   A. Equipment Required - None.

   B. Preparation - Open ELEC TEMP CONTROL circuit breaker (cabin or flight compartment as required).

   C. Remove Flight Compartment Conditioned Air Supply Duct Temperature Sensor.

      (1) Gain access to temperature sensor through forward cargo compartment access door.

      (2) Release cargo compartment liner fasteners (zippered panels) on left bulkhead opposite cargo compartment door. Open liner for access to temperature sensor.

      (3) Disconnect electrical connector from temperature sensor.

         NOTE: The temperature sensor and a thermal limit switch are mounted on top of the small conditioned air supply duct. The temperature sensor is the unit on the left side when viewed from the cargo compartment door while facing inboard.

      (4) Remove screws securing temperature sensor in duct and lift temperature sensor and gasket from duct.

   D. Install Flight Compartment Conditioned Air Supply Duct Temperature Sensor.

      (1) Insert temperature sensor through gasket into mounting hole on top of conditioned air supply duct.

      (2) Align holes in temperature sensor mounting flange with holes in mounting bracket on duct; install and tighten mounting screws.

      (3) Connect electrical connector to temperature sensor.

      (4) Close and fasten cargo compartment liner (zippered panel).

      (5) Close ELEC TEMP CONTROL circuit breakers.

      (6) Perform operational check of air conditioning system (refer to 21-0, Maintenance Practices).

E. Remove Cabin Conditioned Air Supply Duct Temperature Sensor.

NOTE: The cabin conditioned air supply duct temperature sensor is located in the cabin air overhead transition duct at approximately station 715 on the left side of the airplane. The transition duct connects to, and is just aft of the cabin overhead electric heaters.

(1) Gain access to temperature sensor by removing access door in side ceiling trim panel above the passenger hatrack at approximately station 715. Remove button plug in center of access door and remove retaining screw; remove door.

NOTE: If side ceiling trim panel does not contain temperature sensor access door, gain access to sensor by removing side ceiling trim panel (refer to Chapter 25, FURNISHINGS).

(2) Disconnect electrical connector from temperature sensor.

(3) Remove screws securing temperature sensor in transition duct and lift temperature sensor and gasket from duct.

F. Install Cabin Conditioned Air Supply Duct Temperature Sensor.

(1) Insert temperature sensor through gasket and mounting hole in transition duct.

(2) Align holes in temperature sensor mounting flange with holes in transition duct and install and tighten mounting screws.

(3) Connect electrical connector to temperature sensor.

(4) Install access door in side ceiling trim panel and secure with retaining screw. Snap button plug into hole in center of access door.

(5) Close ELEC TEMP CONTROL circuit breaker.

(6) Perform operational check of the air conditioning system (refer to 21-0, Maintenance Practices).

G. Remove Cabin Discharge Duct Temperature Sensor.

NOTE: The cabin discharge duct temperature sensor is located in the air outlet vent just above the passenger compartment floor on the right side of the airplane at approximately station 630.

(1) Gain access to temperature sensor by first removing short section of perforated air grill which covers the air outlet vents. Next, remove small access plate which covers temperature sensors immediately forward of air vent.

NOTE: The cabin discharge duct temperature sensor is the center electrical unit installed in the duct.

(2) Disconnect electrical connector from temperature sensor.

(3) Remove screws securing temperature sensor in discharge duct.

(4) Lift temperature sensor and gasket from duct.

H. Install Cabin Discharge Duct Temperature Sensor.

(1) Insert temperature sensor through gasket into mounting hole in discharge duct.

(2) Align holes in temperature sensor mounting flange with holes in bracket on duct and install and tighten mounting screws.

(3) Connect electrical connector to temperature sensor.

(4) Install access plate over duct and secure with screws, then install perforated air grill over access plate and air outlet vent.

(5) Close ELEC TEMP CONTROL circuit breaker.

(6) Perform operational check of air conditioning system (refer to 21-0, Maintenance Practices).

I. Remove Flight Compartment Discharge Duct Temperature Sensor.

(1) Gain access to flight compartment discharge duct temperature sensor through forward right hand tunnel access door.

(2) Locate flight compartment discharge duct. The temperature sensor is located in duct just forward of where duct extends through bulkhead in front of co-pilot's rudder pedals.

(3) Disconnect electrical connector from temperature sensor.

(4) Remove screws securing temperature sensor in discharge duct.

(5) Remove temperature sensor and gasket from duct.

J. Install Flight Compartment Discharge Duct Temperature Sensor.

(1) Insert temperature sensor through gasket into mounting hole in flight compartment discharge duct.

(2) Align holes in temperature sensor mounting flange with holes in bracket on duct; install and tighten mounting screws.

(3) Connect electrical connector to temperature sensor.

(4) Close ELEC TEMP CONTROL circuit breaker.

(5) Perform operational check of air conditioning system (refer to 21-0, Maintenance Practices).

K. Remove Condenser Ram Air Outlet Duct Temperature Sensor (Thermal Resistor and Connector).

(1) Open Freon package access door (cabin or flight compartment as required).

(2) Remove Freon package (refer to 21-3-1, Maintenance Practices).

(3) Remove nut, washer and screw securing cable clamp to lead between thermal resistor and connector.

(4) Disconnect electrical connector from Freon package harness.

(5) Remove nuts, washers and screws securing connector to mounting bracket on condenser.

(6) Remove screws securing thermal resistor to top of condenser; remove thermal resistor and connector.

L. Install Condenser Ram Air Outlet Duct Temperature Sensor (Thermal Resistor and Connector).

(1) Place thermal resistor in hole in condenser and secure with screws and washers.

NOTE: Check for presence of gasket between condenser and thermal resistor.

(2) Position connector on mounting bracket on condenser; secure with screws, washers and nuts.

(3) Install cable clamp on lead between thermal resistor and connector.

(4) Connect electrical receptacles of Freon package harness and thermal resistor and connector.

(5) Install Freon package (refer to 21-3-1, Maintenance Practices).

(6) Close Freon package access door.

ELECTRONIC TEMPERATURE CONTROL - MAINTENANCE PRACTICES

1. Removal/Installation Electronic Temperature Control

A. Equipment Required - None.

B. Preparation.

(1) Open cabin or flight compartment ELEC TEMP CONTROL circuit breaker as required.

(2) Gain access to control through forward cargo compartment access door.

C. Remove Electronic Temperature Control.

(1) Remove safety wire and loosen two knurled nuts which lock temperature control in mounting rack. (Knurled nuts will swing free of control when loosened.)

(2) Grasp handle on temperature control and pull control forward to remove from mounting rack.

CAUTION: PULL TEMPERATURE CONTROL FORWARD HORIZONTALLY TO PREVENT DAMAGE TO ELECTRICAL CONNECTOR IN BACK OF CONTROL.

D. Install Electronic Temperature Control.

(1) Slide temperature control aft on mounting rack.

CAUTION: BE SURE THAT TEMPERATURE CONTROL IS PROPERLY CENTERED IN RACK BEFORE SLIDING ALL THE WAY AFT. IMPROPER ALIGNMENT MAY DAMAGE THE CONNECTOR IN BACK OF THE CONTROL.

(2) Raise knurled nuts into position over locking pins on face of control. Tighten nuts by hand only and install safety wire.

(3) Close ELEC TEMP CONTROL circuit breaker.

(4) Perform operational check of air conditioning system (refer to 21-0, Maintenance Practices).

2. Inspection/Check Electronic Temperature Control

A. Check Temperature Control.

(1) Examine exterior of control for the following:

(a) Paint shall not be damaged.

(b) Surfaces shall not be bent or dented enough to cause malfunction due to distortion or grounding of internal components.

(2) Examine electrical receptacle for damage or distortion.

(3) Examine control interior.

(a) Electrical connections shall be mechanically and electrically secure.

(b) Fuses shall be secure in their mounting clips.

(c) Screws and nuts shall be tight.

(d) Resistors and capacitors supported and fastened by their electrical leads shall be positioned to prevent shorts.

(4) Examine protective cover; it shall be fully seated against face of control and screws that fasten it to control shall be tight.

3. Cleaning/Painting

A. Clean Temperature Control.

(1) Wipe control with lint-free cloth dampened, not saturated, with AMS 3160A solvent to remove grease or oil deposits.

NOTE: Do not immerse control into solvent nor allow solvent to enter control or electrical receptacle.

(2) Clean interior of control and electrical receptacle with soft clean brush and with oil and moisture free low pressure compressed air.

NOTE: Inhibisol, manufactured by the Pentone Company, 75 Hudson Ave., Tenafly, New Jersey, may be used for cleaning interior of temperature control.

B. Paint Temperature Control.

(1) Touch up worn or damaged painted surfaces as follows:

(a) Apply primer coat of zinc chromate AMS 3110C to obtain semi-transparent greenish-yellow surface.

(b) Allow primer to air dry 30 minutes at room temperature.

(c) Apply two topcoats of glyceryl phthalate black enamel, AMS 3120B.

(d) Allow each coat of enamel to air dry 4 hours at room temperature before applying the second coat or before handling.

4. Approved Repairs

A. Remove corrosion on exposed metal surfaces.

(1) Polish out with fine crocus cloth and repaint.

B. Replace power input and manual control power fuses.

(1) Remove protective cover from control by removing retaining screws and sliding cover off receptacle end of control.

(2) Locate two fuses mounted above manual transformer at electrical receptacle end of control. The outboard fuse is the manual fuse, and the inboard fuse is the power input fuse; replace faulty fuse(s).

CAUTION: SIX AMPLIFIER FUSES ARE LOCATED ON OPPOSITE SIDE OF POWER INPUT AND MANUAL FUSE MOUNTING CLIPS. SHOULD A BLOWN AMPLIFIER FUSE BE ENCOUNTERED, DO NOT REPLACE FUSE. SEND MALFUNCTIONING CONTROL TO OVERHAUL.

(3) Install protective cover on control by sliding cover over receptacle end of control; seat cover fully and secure with screws.

SEQUENCING DEVICE - MAINTENANCE PRACTICES

1. Removal/Installation Sequencing Device (see Figure 201)

   A. Equipment Required - None.

   B. Preparation.

      (1) Open ELEC TEMP CONTROL circuit breaker (cabin or flight compartment as required).

      (2) Open Freon package access door (cabin or flight compartment as required).

   C. Remove Sequencing Device.

      (1) If Freon package is mounted in airplane, disconnect electrical connector from sequencing device. (Cap connector and receptacle. Tag harness for installation.)

      (2) While supporting sequencing device, cut lock wire and remove bolts securing sequencing device to bellows control on Freon package. (Three bolts are removed from the bottom, and one from the top.)

      (3) Remove sequencing device.

   D. Install Sequencing Device.

      (1) Place open side of sequencing device against mounting flange on bellows control.

         (a) Electric motor shall be toward aft end of Freon package.

         (b) Back pressure cam in sequencing device shall contact bellows control cam follower.

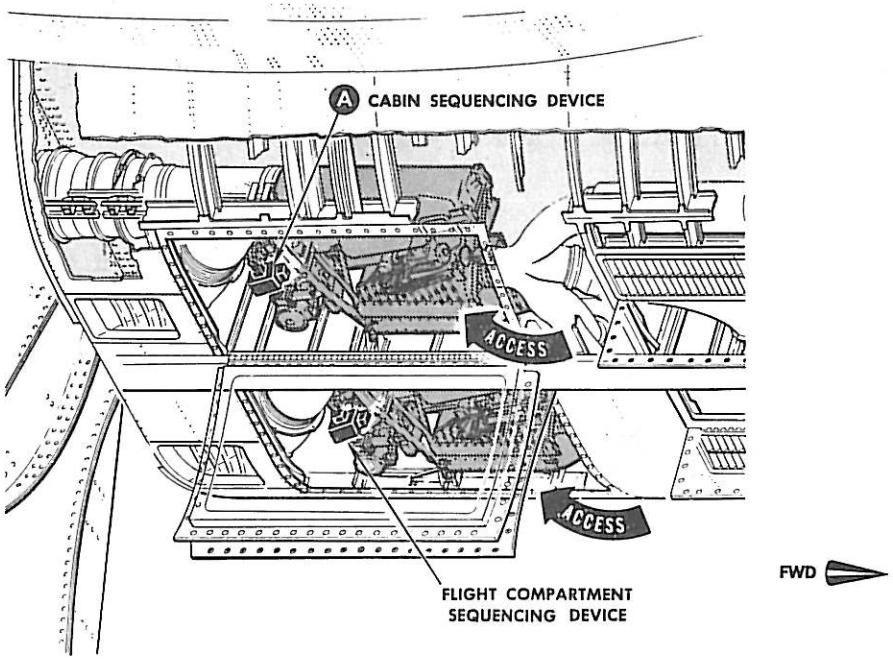
      (2) Secure sequencing device to bottom of bellows control with bolts. Install three bolts (with washers under bolt heads) through bellows control mounting flanges and screw bolts into threaded holes on sequencing device. Install right rear bolt through sequencing device into bellows control; safety bolts with lockwire.

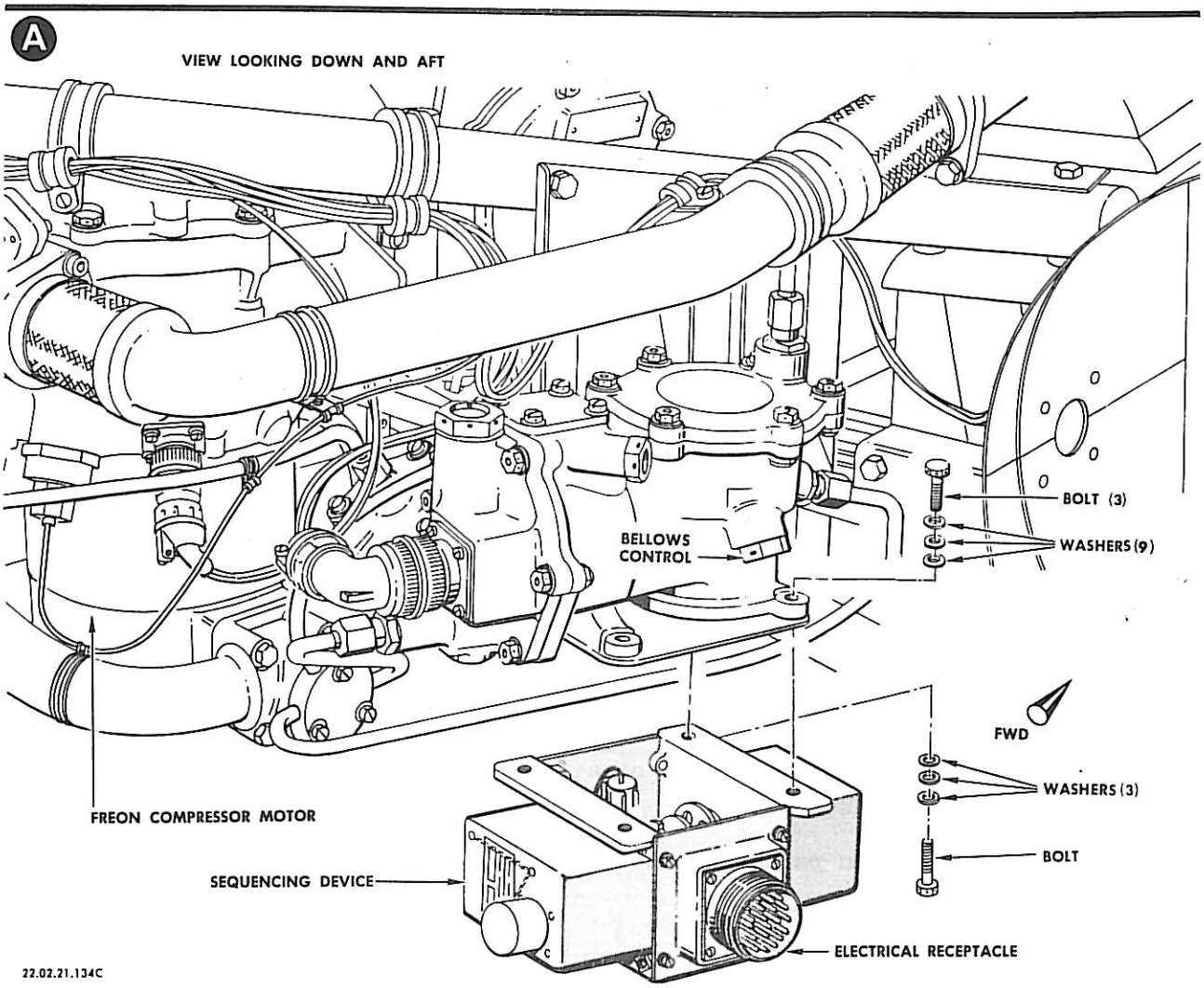
      (3) If Freon package is installed in airplane, connect electrical harness from airplane to sequencing device.

      (4) Close ELEC TEMP CONTROL circuit breaker.

      (5) Perform operation check of air conditioning system (refer to 21-0, Maintenance Practices).

      (6) Close Freon package access door.





Sequencing Device Installation
Figure 201

2. Inspection/Check

A. Examine Sequencing Device Exterior.

(1) Check mounting flange for bends or distortion.

(2) Check the condition of external wiring.

(3) Examine receptacle terminals for damage.

(4) Check each cap or cover for dents, cracks or scratches.

(5) Examine all external surfaces for damage or worn paint.

3. Cleaning/Painting

A. Clean the Sequencing Device.

(1) Clean exterior surfaces with solvent, Specification AMS 3160A, to remove any dirt, grease or oil deposits.

CAUTION: DO NOT IMMERSE SEQUENCING DEVICE IN CLEANER. CLEAN EXTERIOR WITH LINTLESS CLOTH OR SOFT BRUSH MOISTENED WITH CLEANER.

(2) Remove deposits from the cams using a soft cloth moistened with cleaner.

B. Paint the Sequencing Device Housing.

(1) Touch up worn or damaged painted surfaces when the extent of damage does not exceed one square inch or five percent of the total painted area. When damage exceeds these limits send the sequencing device to overhaul.

(a) Remove corrosion with steel wool or crocus cloth prior to application of paint.

(b) Apply a priming coat of zinc chromate, Specification AMS 3110C, to obtain a semi-transparent greenish yellow surface.

(c) Allow primer to air dry 30 minutes at room temperature.

(d) Apply one coat of glyceryl phthalate black enamel, Specificatior AMS 3120B, with brush or spray.

CAUTION: MASK ALL PORTS AND UNPAINTABLE AREAS PRIOR TO PAINTING.

(e) Allow paint to air dry 4 hours at room temperature.

CONDENSER TEMPERATURE CONTROL - DESCRIPTION AND OPERATION

1. Description

The condenser temperature control is mounted on top of the evaporator Freon outlet header near the aft frame. It contains a receptacle for connection to an electrical harness and consists essentially of a power supply, transistor amplifier, magnetic modulator and a resistance bridge circuit.

The power supply provides ac and dc voltage for operation of the magnetic modulator, and dc voltage for operation of the amplifier and bridge circuit.

2. Operation

The condenser temperature control functions in conjunction with a thermal resistor located in the condenser ram air outlet duct, and the condenser cooling air modulating valve. It uses the variable resistance of the thermal resistor to provide a control voltage of the proper phase to position the cooling air modulating valve.

The thermal resistor completes the bridge circuit of the temperature control. When ram air from the condenser core is at a predetermined temperature, the resistance of the thermal resistor is such that the bridge is in balance and no current flows through the signal winding of the magnetic modulator. When this condition exists, no signal is generated at the output of the modulator to provide control voltage to the condenser cooling air modulating valve, and the valve remains in a set position.

Should condenser ram air discharge temperatures increase, the resistance of the thermal resistor and connector decreases, causing bridge circuit imbalance and current flow through the signal winding of the magnetic modulator. The ac output from the output winding will have the proper phase to provide a control voltage to drive the condenser cooling air modulating valve toward the open position. Should condenser ram air discharge temperatures decrease, resistance of the thermal resistor and connector increases, causing bridge imbalance and subsequent current flow through the signal winding of the modulator in the opposite direction as with increasing ram air temperatures. The control voltage under these conditions has a 180 degree phase shift to drive the condenser cooling air modulating valve toward the closed position.

A second voltage signal, beside the error voltage from bridge imbalance, is applied to the signal winding of the magnetic modulator. This is a voltage proportional to the rate of change of the condenser cooling air modulating valve actuator rotation. This voltage is capacitance coupled to the signal winding from the rate feedback potentiometer wiper in the valve and is only applicable when the potentiometer wiper is moved (valve actuator rotation occurs). Thus, once valve actuator rotation has started, the rate of change voltage from the potentiometer wiper reduces the initial starting signal to the valve actuator to keep rotation at a slow rate.

CONDENSER TEMPERATURE CONTROL - MAINTENANCE PRACTICES

1. Removal/Installation Condenser Temperature Control (see Figure 201)

   A. Equipment Required - None.

   B. Preparation.

      (1) Open FREON SYS CONT, CONDENSER GROUND COOLING and ELEC TEMP CONTROL circuit breakers (cabin or flight compartment as required).

      (2) Open Freon package access door (cabin or flight compartment as required).

   C. Remove Condenser Temperature Control.

      (1) Disconnect electrical connector on bottom of condenser temperature control. (Cap connector and receptacle. Tag harness for installation.)

      (2) Remove four mounting bolts which secure control to Freon package frame.

      (3) Remove condenser temperature control.

   D. Install Condenser Temperature Control.

      (1) Position condenser temperature control against package frame with electrical receptacle up.

      (2) Insert four mounting bolts with washers through control and into package frame.

      (3) Connect electrical connector to condenser temperature control.

      (4) Close FREON SYS CONT, CONDENSER GROUND COOLING and ELEC TEMP CONTROL circuit breakers.

      (5) Perform operational check of air conditioning system (refer to 21-0, Maintenance Practices).

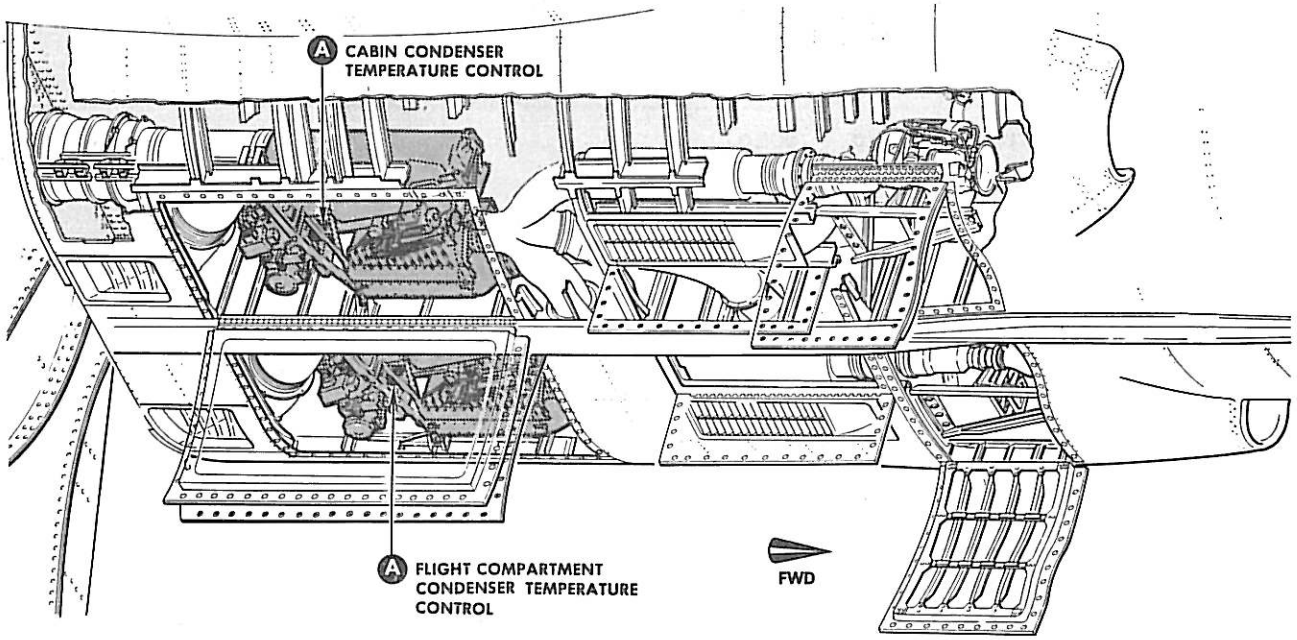
2. Inspection/Check

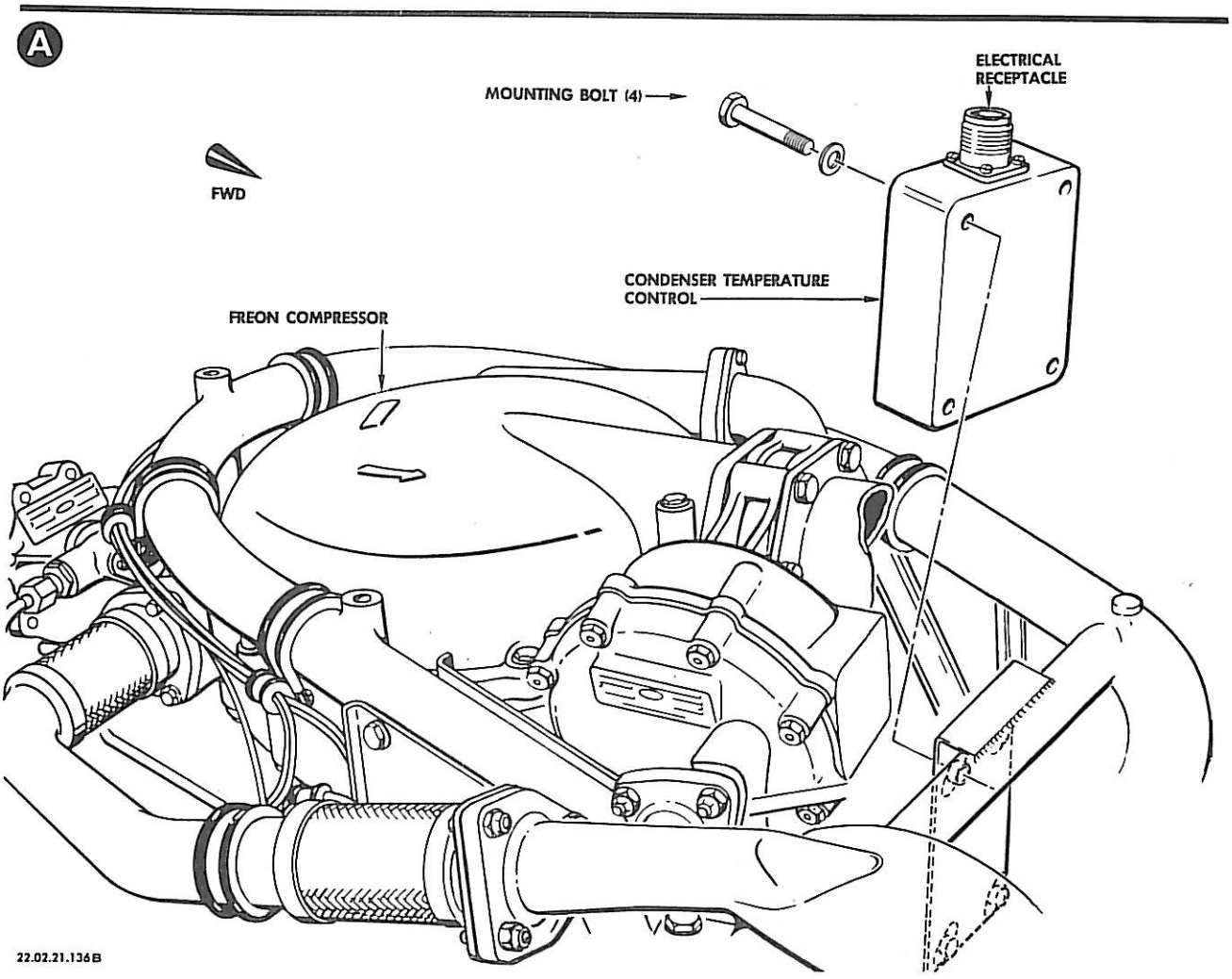
   A. Check control for the following:

      (1) Examine exterior of control for damage to paint or cracks in potting material. Determine if crack has affected any electronic wiring, if so, replace control.

      (2) Check electrical receptacle for damage or distortion.

      (3) Check mounting bolts for security.





Condenser Temperature Control Installation
Figure 201

3. Cleaning/Painting

A. Clean Condenser Temperature Control. Wipe with lint free cloth dampened with solvent, Specification AMS 3160A, to remove grease or oil deposits.

NOTE: Do not immerse unit in solvent or allow solvent to enter electrical receptacle.

B. Paint Condenser Temperature Control.

(1) Mask off electrical receptacle and identification plate.

(2) Prime surfaces with thin coat of zinc chromate, Specification AMS 3110C, to obtain a semitransparent greenish coating; allow prime coat to dry 30 minutes at room temperature.

(3) Apply coat of black lacquer, Specification MIL-L-6805; allow to dry 45 minutes at room temperature.

4. Approved Repair

A. Repair Condenser Temperature Control. Remove corrosion on exposed metal surfaces; polish surfaces with fine crocus cloth.

AIR CONDITIONING SUBSYSTEM SWITCHES - DESCRIPTION AND OPERATION

1. General

A number of function switches and controls are provided for the operation of the air conditioning and pressurization system. The switches provide for both automatic or manual control of the systems. Indicators are also provided on the air conditioning and pressurization control panels, some of which are designed to indicate various functions as controlled by the selectors. For the detailed interconnection of these controls refer to 21-4-0, Figure 1. A brief description of each of the various switches follows:

A. Freon Compressor MASTER ON-OFF Switch.

The Freon compressor MASTER ON-OFF switch is a single-pole, double-throw switch which provides power for the control of both the cabin and flight deck Freon refrigeration system.

B. Freon Compressor FLT DECK OFF-BOTH ON-CABIN OFF Switch.

The Freon compressor FLT DECK OFF-BOTH ON-CABIN OFF switch is a three-position, multi-unit microswitch which controls both the cabin and flight deck Freon systems.

C. RAM AIR SOURCE OPEN-CLOSE Switch.

The RAM AIR SOURCE OPEN-CLOSE switch is a three-position switch which controls the positioning of the ram air valve actuator from open to closed. (Ram air pressure must exceed cabin pressure before the valve butterfly will open.)

D. Turbocompressor AUTO-OFF-MAN ON Switch.

The turbocompressor AUTO-OFF-MAN ON switch is a double-pole, triple-throw switch which controls the application of 28-volt dc power to the ON-OFF solenoid.

E. Temperature Control AUTO-OFF-MAN Switch.

The temperature control AUTO-OFF-MAN switches are three-pole, double-throw switches. In the MAN position they allow temperature control through the manual temperature control MAN HOT-MAN COLD switch.

F. Temperature Control MAN HOT-MAN COLD Switches.

The temperature control MAN HOT-MAN COLD switches are single-pole, double-throw momentary switches which can only function when their respective temperature control AUTO-OFF-MAN switch is in the MAN position. The MAN HOT position increases the heating level of the system, and the MAN COLD position increases the cooling level. The amount of heating or cooling is dependent on how long the switch is held in either position.

G. RECIRCULATING BLOWER AUTO-OFF-MAN Switch.

The RECIRCULATING BLOWER AUTO-OFF-MAN switch is utilized in recirculating cabin air. Cabin air recirculation is accomplished by opening the recirculation control valve and operating the recirculation fan.

H. CABIN TEMP EQ CONT ON-OFF Switch.

The CABIN TEMP EQ CONT ON-OFF switch is used to control the contactor which supplies power to the system. It is a two-pole, double-throw switch and receives power from the Freon compressor MASTER ON-OFF switch.

I. FREON RESET Switch (FLT DECK-CABIN).

The FREON RESET switch is a single-pole, double-throw switch which applies 28-volt dc power to the reset winding of the lockout relay. There is also a manually operated reset switch on the lockout relay box.

J. Manual Reset Switches.

(1) Freon Reset FLT DECK-CABIN Switch.

The FREON RESET FLT DECK-CABIN switch is a single-pole, double-throw momentary switch which is used to reset the lockout relay after being tripped by the compressor discharge over-pressure switch.

(2) Recirculation Fan Lockout Relay Reset Switch.

The recirculation fan relay reset switch is a single-pole, push-button switch to reposition the lockout relay. The relay is thrown to the off position by a bimetallic thermal switch whenever an overheat condition exists within the fan motor. When the motor has cooled the overheat switch returns to the open position, but the lockout relay must be manually reset.

(3) Turbocompressor Overspeed Reset Switch.

The turbocompressor overspeed switch is actuated by a fly-weight assembly in the turbocompressor when an overspeed condition occurs. The switch when actuated shuts off the flow of engine bleed air to the turbocompressor and energizes a circuit to the indicator light on the flight engineer's panel. The turbocompressor cannot be restarted until the manual reset switch is actuated on the ground.

K. 160 Degree Thermal Switch.

The 160 degree F thermal switches, shown on Figure 1, are two-position switches which sense duct air temperature prior to entering the cabin and flight compartments. Each switch is wired in parallel with the MAN COLD position of the manual temperature control MAN HOT-MAN COLD switch. In the event that maximum heat is scheduled by manual control, the thermal switch will override the MAN HOT switch action if duct temperature exceeds 160 degrees F, and thus cause a cooling cycle to occur.

L. Ground Safety Relays (Landing Gear Ground Safety Switch).

The ground safety relays determine the ground or airborne sequence of operation for the various components in the air conditioning system.

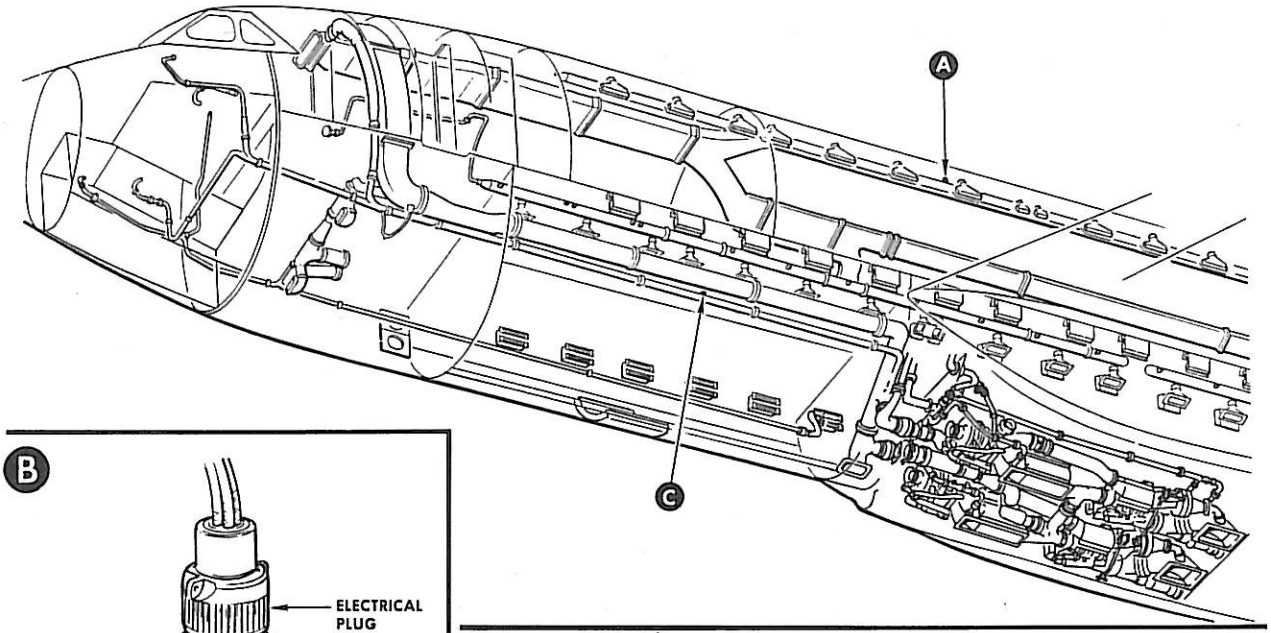
M. Freon Lockout Relay.

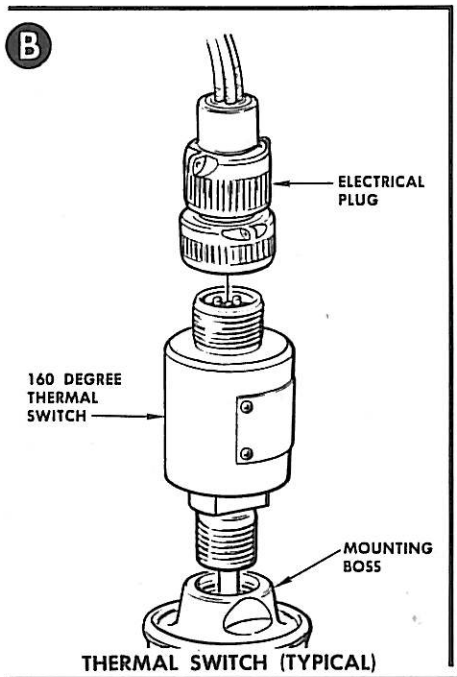
The Freon lockout relay box, shown on Figure 2, is mounted on the forward end of the evaporator. The box serves as a junction for those components which are mounted on the Freon package. It contains a relay, a switch, and the necessary connectors for the interconnection of components. The relay is a magnetic latching relay containing two permanent magnets. The 115-volt relay contacts are open when the relay is deenergized.

The lockout relay normally provides a ground for completion of the control circuit to the Freon compressor on-off motor relay. The lockout relay is controlled by the action of four compressor function switches; the compressor discharge over-pressure switch, the compressor discharge over-temperature switch, the Freon compressor motor over-temperature switch, and the compressor motor protector. These circuits are wired in parallel so that a malfunction in any of the above functions will energize the close windings of the lockout relay. The lockout relay can be reset by a reset button on the bottom of the relay or by a switch on the flight engineer's panel. The reset circuit applies 28-volt dc power to the reset windings of the relay.

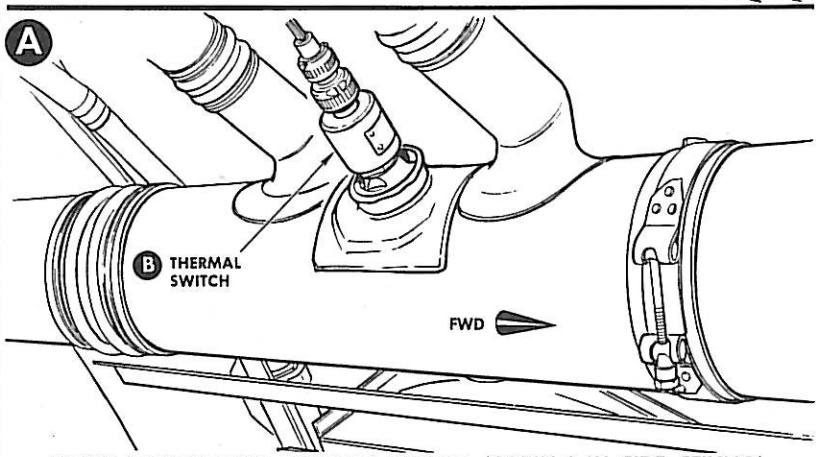
N. Condenser Cooling Control Relays.

The condenser cooling control relays are four-pole, double-throw relays with normally closed contacts. The relays are located within the relay and circuit breaker boxes in the Freon package compartments. These relays, in conjunction with the condenser cooling air pressure switch, determine the operation of the various components used for cooling the Freon condenser.

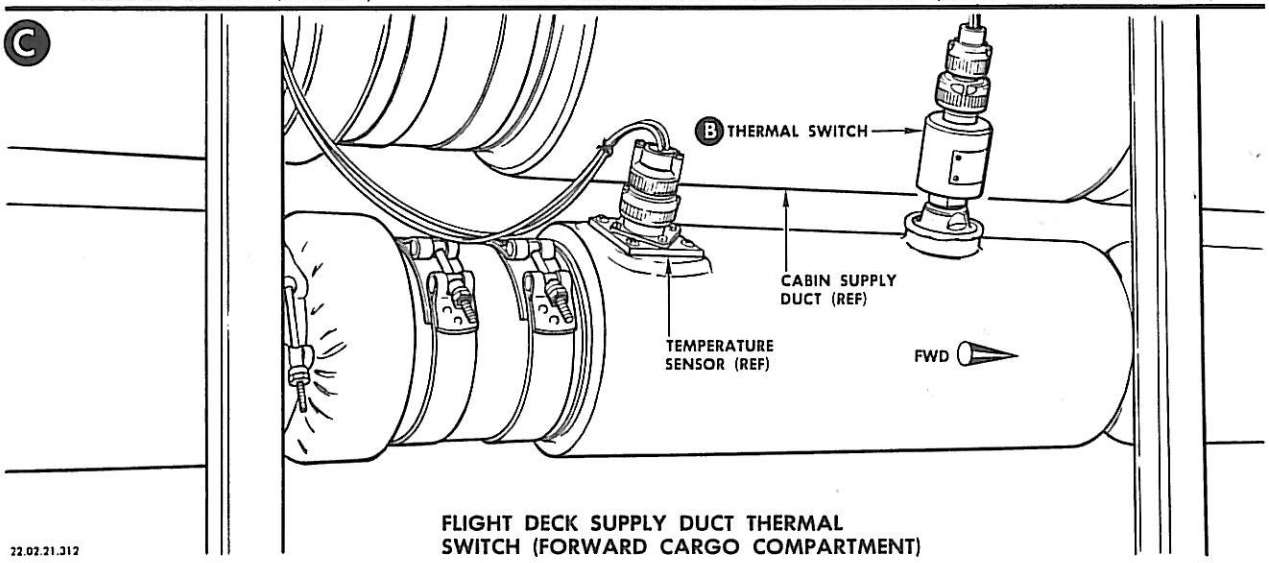




THERMAL SWITCH (TYPICAL)



CABIN SUPPLY DUCT THERMAL SWITCH (CABIN L/H SIDE CEILING)



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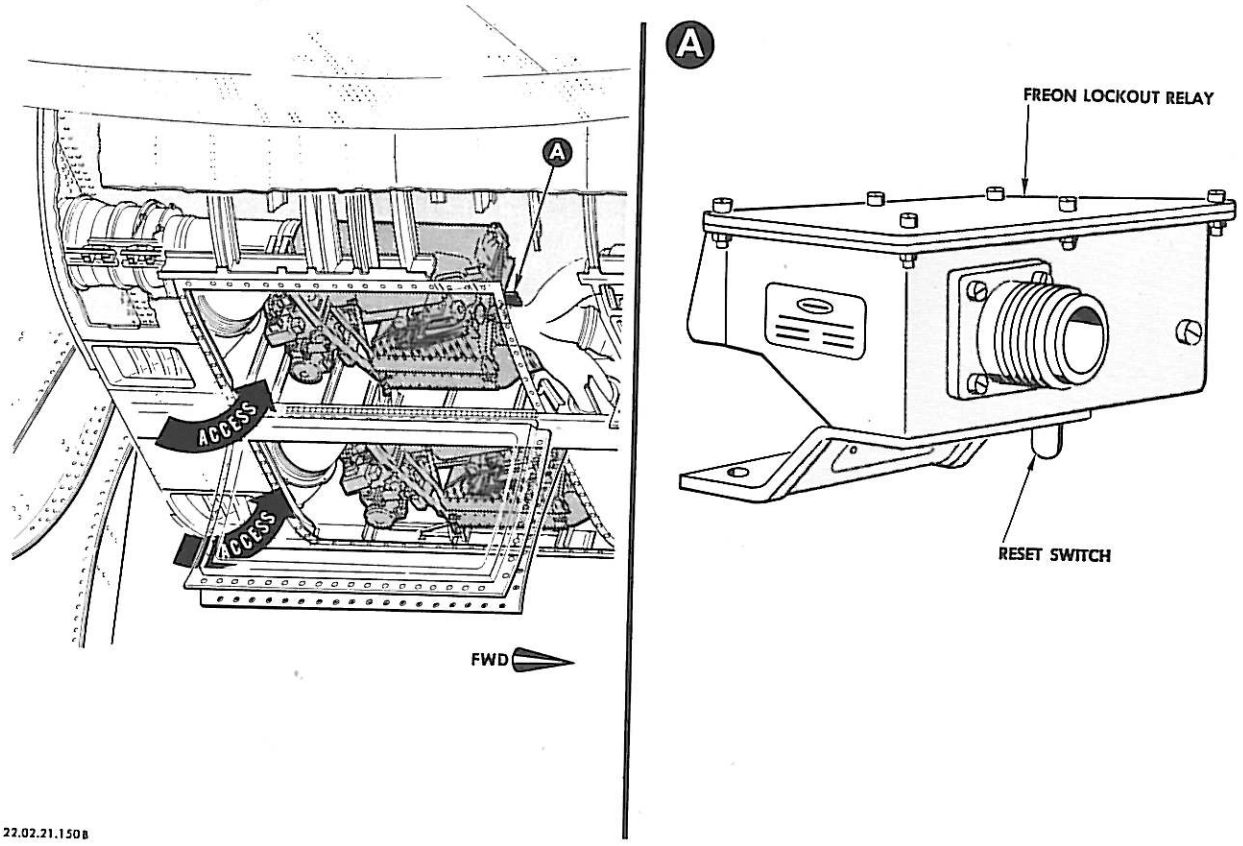
FLIGHT DECK SUPPLY DUCT THERMAL SWITCH (FORWARD CARGO COMPARTMENT)


A
ACCESS
ACCESS
FWD
A
FREON LOCKOUT RELAY
RESET SWITCH
22.02.21.150B

THERMAL SWITCHES (160 DEGREE F) - MAINTENANCE PRACTICES

1. Removal/Installation Thermal Switch

A. Equipment Required - None.

B. Preparation. Open ELEC TEMP CONTROL circuit breaker (cabin or flight compartment as required).

C. Remove Flight Compartment Conditioned Air Supply Thermal Switch.

(1) Gain access to thermal switch through forward cargo compartment access door.

(2) Release cargo compartment liner fasteners (zippered panels) on left bulkhead opposite cargo compartment door. Open liner for access to thermal switch.

(3) Disconnect electrical connector from thermal switch.

NOTE: The thermal switch and a temperature sensor are installed on top of the small conditioned air supply duct. The thermal switch is the unit on the right side when viewed from the cargo compartment door.

(4) Unscrew thermal switch from conditioned air supply duct.

CAUTION: USE WRENCH ON WRENCH-FLAT PROVIDED ON DUCT MOUNTING BOSS TO COUNTERACT TORQUE WHEN LOOSENING THERMAL SWITCH.

(5) Remove thermal switch and gasket from supply duct.

D. Install Flight Compartment Conditioned Air Supply Thermal Switch.

(1) Insert thermal switch with gasket into duct mounting boss and screw in to tighten.

CAUTION: USE WRENCH ON WRENCH-FLAT PROVIDED ON DUCT MOUNTING BOSS TO COUNTERACT TORQUE WHEN TIGHTENING THERMAL SWITCH.

(2) Connect electrical connector to thermal switch.

(3) Close and fasten cargo compartment liner (zippered panel).

(4) Close ELEC TEMP CONTROL circuit breaker.

E. Remove Cabin Conditioned Air Supply Thermal Switch.

NOTE: The cabin conditioned air supply thermal switch is located in the passenger compartment left side overhead air inlet manifold. The thermal switch is mounted in the manifold just below and outboard of the cabin electric heaters.

(1) Gain access to thermal switch by removing side ceiling trim panel above the passenger hatrack at approximately station 612. (Refer to Chapter 25, FURNISHINGS).

(2) Disconnect electrical connector from thermal switch.

(3) Unscrew thermal switch from air inlet manifold.

CAUTION: THE AIR INLET MANIFOLD IS MANUFACTURED FROM FIBERGLAS. USE WRENCH ON WRENCH-FLAT PROVIDED ON MANIFOLD MOUNTING BOSS TO COUNTERACT TORQUE WHEN LOOSENING THERMAL SWITCH.

(4) Remove thermal switch and gasket from manifold.

F. Install Cabin Conditioned Air Supply Thermal Switch.

(1) With gasket in place, insert thermal switch into mounting boss on air inlet manifold and screw in thermal switch to tighten.

CAUTION: THE AIR INLET MANIFOLD IS MANUFACTURED FROM FIBERGLAS. USE WRENCH ON WRENCH-FLAT PROVIDED ON MANIFOLD MOUNTING BOSS TO COUNTERACT TORQUE WHEN TIGHTENING THERMAL SWITCH.

(2) Connect electrical connector to thermal switch.

(3) Install side ceiling trim panel (refer to Chapter 25, FURNISHINGS).

(4) Close ELEC TEMP CONTROL circuit breaker.

2. Adjustment/Test Thermal Switch

A. General - A functional test of the thermal switch after installation in the airplane is not practical. The following test shall be performed with the thermal switch removed from the airplane.

B. Equipment Required.

(1) A liquid or air bath having a variable temperature range of 140 to 180 degrees F (60 to 82.2 degrees C).

(2) An ohmmeter.

(3) A calibrated thermometer.

C. Preparation.

(1) Remove thermal switch from airplane (refer to Removal/Installation).

(2) Heat liquid or air bath to 140 degrees F.

D. Test Thermal Switch.

(1) Immerse thermal switch probe in liquid or air bath and heat to 140 degrees F.

(2) Perform continuity checks with ohmmeter:

(a) There shall be continuity between terminals A and C.

(b) There shall be no continuity between terminals B and C.

(3) Raise temperature of liquid or air bath to 180 degrees F.

(4) Perform continuity checks with ohmmeter.

(a) There shall be continuity between terminals B and C.

(b) There shall be no continuity between terminals A and C.

(5) Lower temperature of liquid or air bath to 140 degrees F, and repeat step (2) above.

NOTE: Thermal switches which do not operate in the range of 150 to 170 degrees F on either increasing or decreasing temperatures shall be replaced.

(6) Install thermal switch (160 degrees F) in airplane (refer to Removal/Installation).

3. Inspection/Check

A. Visual Check.

(1) Examine exterior of thermal switch.

(a) Threads on probe and electrical receptacle shall not show damage.

(b) Probe shall not be bent or damaged.

(c) Unit shall be free of cracks.

4. Cleaning/Painting

A. Cleaning.

(1) Wipe exterior surface of thermal switch with a clean dry cloth.

(2) Clean interior of electrical connector with a soft clean paint brush.

CONDENSER COOLING CONTROL RELAYS - MAINTENANCE PRACTICES

1. Removal/Installation Condenser Cooling Control Relays

   A. Equipment Required - None.

   B. Preparation - Open CABIN and FLIGHT DECK FREON SYS CONT and CONDENSER GROUND COOLING CIRCUIT BREAKERS.

   C. Remove CONDENSER COOLING CONTROL Relay.

      (1) Gain access to relay to be replaced through Freon package access door (cabin or flight deck as required).

      NOTE: Relays are on compartment overhead between outboard edge of compartment opening and Freon package.

      (2) Remove relay and circuit breaker box cover.

      (3) Remove mounting screws and lock washers securing relay inside box.

      (4) Pull relay out of socket.

   D. Install Condenser Cooling Control Relay.

      (1) Align relay locating pins with locating holes in socket and insert relay into socket.

      (2) Install and tighten mounting screws and washers to secure relay.

      (3) Close relay and circuit breaker box cover.

      (4) Close CABIN and FLIGHT DECK FREON SYS CONT and CONDENSER GROUND COOLING circuit breakers. Check operation of relay.

FREON LOCKOUT RELAY - MAINTENANCE PRACTICES

1. Removal/Installation Freon Lockout Relay (See Figure 201)

   A. Equipment Required - None.

   B. Preparation.

      (1) Open FREON SYS CONTROL circuit breaker (cabin or flight compartment as required).

      (2) Open Freon package access door (cabin or flight compartment as required).

   C. Remove Freon Lockout Relay.

      (1) Disconnect electrical connectors on forward and aft ends of Freon lockout relay. Lockout relay is mounted on upper forward end of Freon evaporator. (Cap connectors and receptacles. Tag harnesses for installation.)

      (2) Remove two nuts and washers from upper end of evaporator mounting bolts.

      (3) Remove evaporator mounting bolts and spacers to release lockout relay from Freon package.

   D. Install Freon Lockout Relay.

      (1) Position lockout relay so that relay mounting brackets extend above and below upper mounting bracket on forward end of Freon evaporator.

      (2) Position large spacer and two washers as illustrated, and insert evaporator mounting bolts from the bottom.

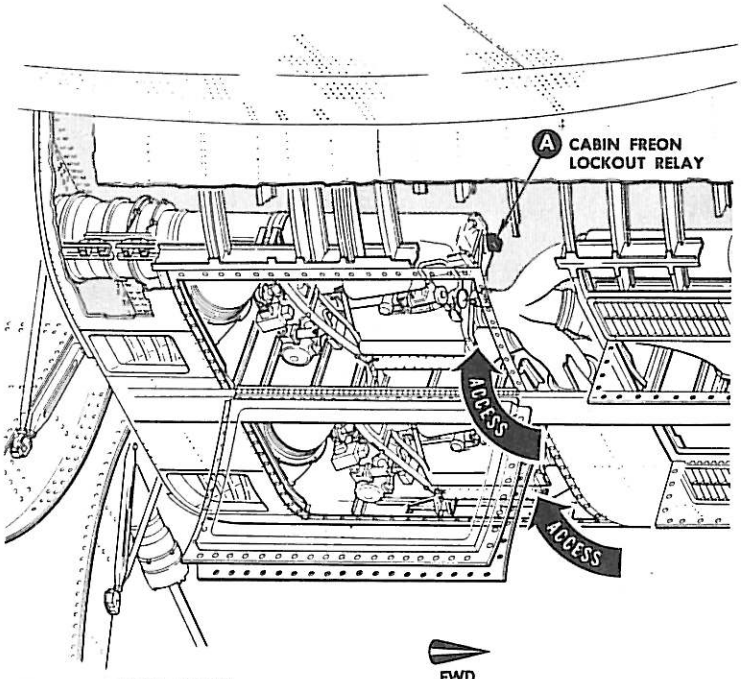
      (3) Secure bolts in position with washer and nut on top.

      (4) Connect electrical connector to forward and aft receptacle on lockout relay.

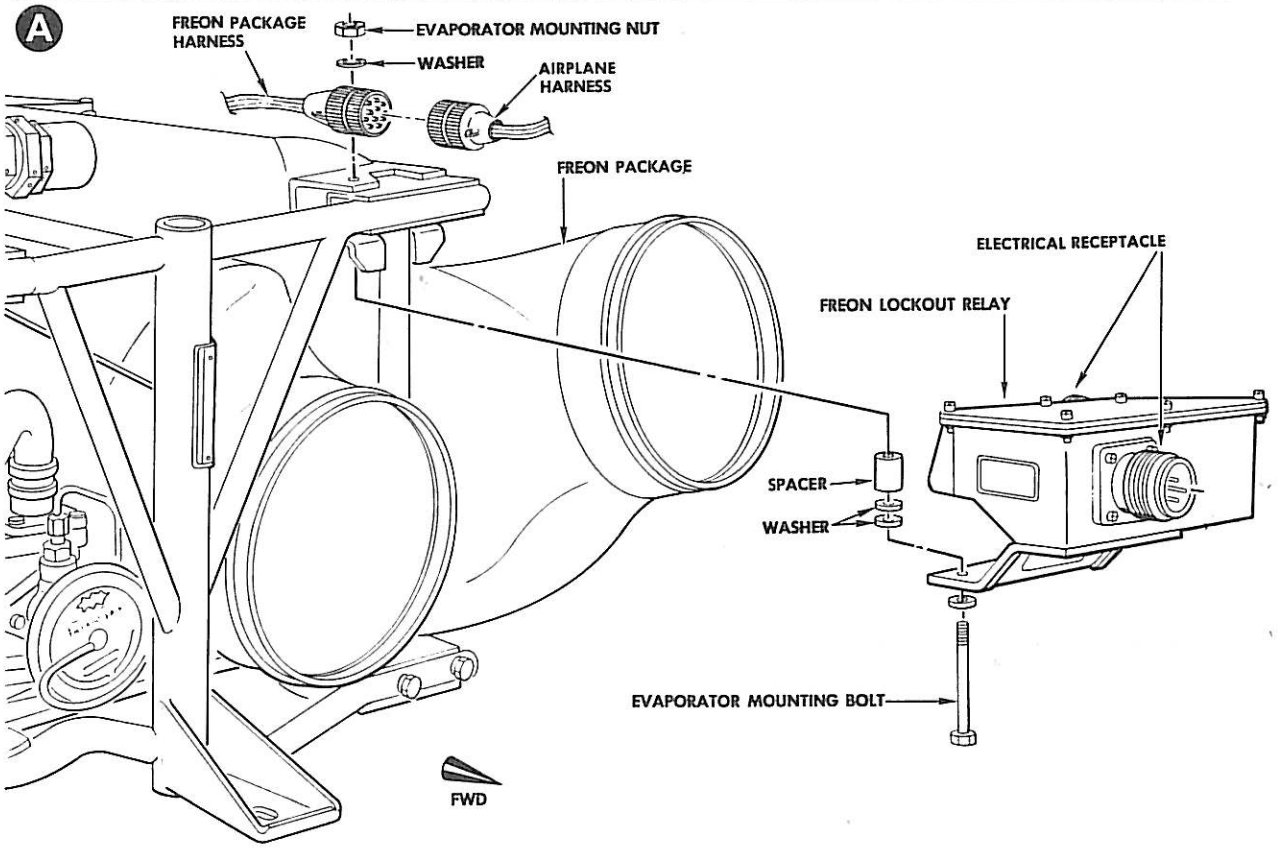
      (5) Perform operational test (refer to Adjustment/Test).

2. Adjustment/Test Freon Lockout Relay

   A. Equipment Required. A locally manufactured test harness consisting of a connector, two wires and a switch. The connector must fit in place



A FLIGHT COMPARTMENT FREON LOCKOUT RELAY NOT SHOWN



22.02.21.135 B

Freon Lockout Relay Installation
Figure 201

of the Freon compressor overtemperature protection switch, or the compressor overpressure protection switch. The switch, when closed, must connect the two terminals on the connector to simulate the closing of a protection switch on the Freon package.

B. Preparation.

(1) Open Freon package access door (cabin or flight compartment).

(2) Connect electrical ground cart to airplane.

(3) Start and operate Freon package which is to be tested (refer to 21-0, Maintenance Practices).

C. Test Freon Lockout Relay.

NOTE: If lockout relay has been replaced, it may be in lockout position. If FREON FAIL warning light is illuminated, press reset button on bottom of lockout relay to start compressor and condenser fan. (Electric power is required to reset lockout relays.)

(1) Remove connector from overpressure switch and connect test harness. (Be sure harness switch is in open position.)

(2) With Freon compressor running, close switch on test harness to simulate an overpressure or overtemperature condition. The Freon package shall shut down, and the FREON FAIL warning light shall illuminate.

(3) With relay in lockout position, press reset button on bottom of Freon lockout relay. The FREON FAIL warning light shall extinguish immediately and after a delay of approximately 20 seconds, the Freon compressor shall start.

(4) When test are completed, shut down system and remove test harness. Connect package harness connector to switch from which it was removed.

(5) Close Freon package access door.

(6) Disconnect external electrical power source from airplane.

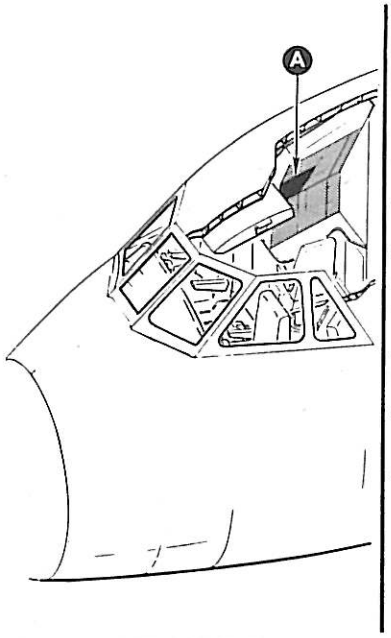
AIRFLOW INDICATOR AND FLOW SENSOR AND TRANSMITTER - DESCRIPTION AND OPERATION

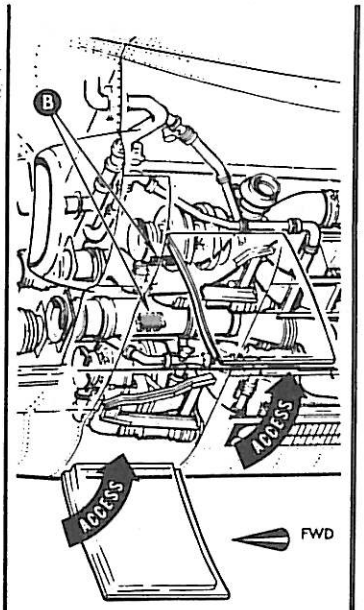
1. Description

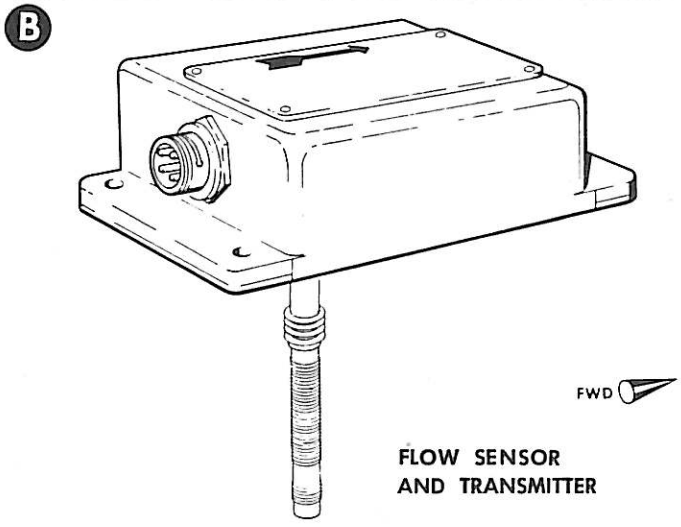
The airflow indicator is a dual microammeter, calibrated in units of airflow (pounds per minute). The flow sensor and transmitter, shown on Figure 1, consists of a probe extending from the transmitter into the cabin and flight deck conditioned air supply ducts. The probe contains platinum sensing elements connected to a dc resistance bridge in the transmitter.

2. Operation

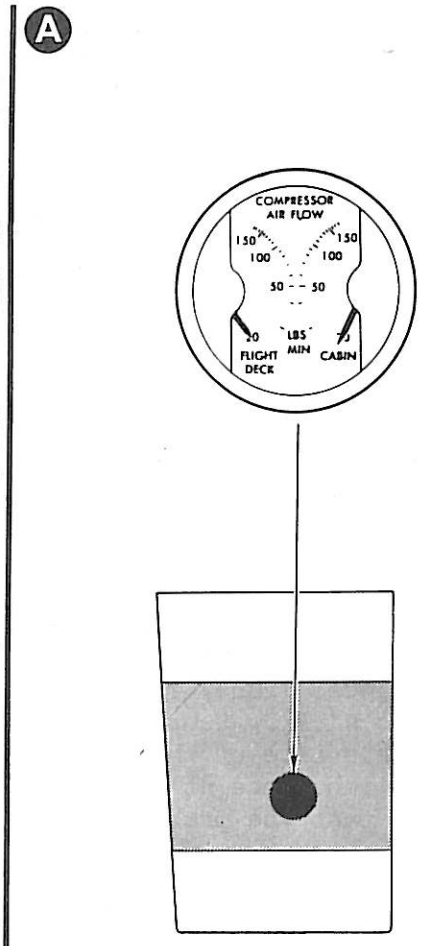
The sensing elements on the probe form two legs of a bridge circuit with 28-volt dc power to each element. The longer probe element has a blocking resistor in series with the element so current flow across it will not raise the temperature of the element by any appreciable amount. The smaller probe element is heated by the 28-volt dc power. As air flows across the smaller element it lowers the temperature of the element and consequently changes the resistance, unbalancing one leg of the bridge circuit. The effects of airflow across the longer element are insignificant in the effect on its resistance. Thus, the longer element establishes a constant in relationship to airflow temperature changes. This constant is compared against the resistance of the shorter element in the bridge circuit. The resultant bridge imbalance at the microammeter supplies a reading of relative air volume past the probes.



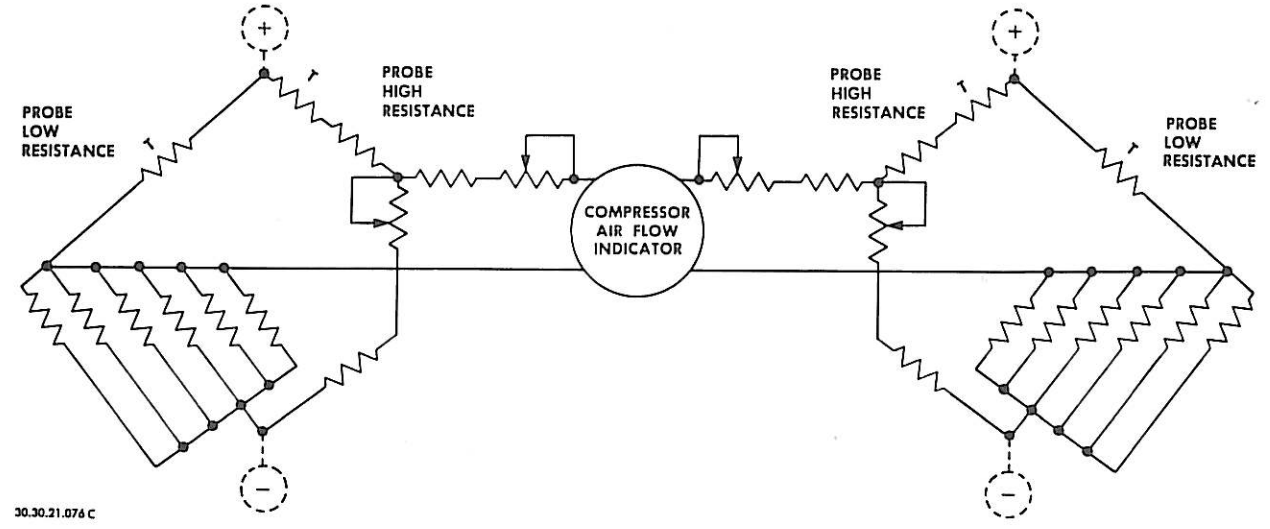




FLOW SENSOR
AND TRANSMITTER



FLIGHT ENGINEER'S AIR CONDITIONING
AND PRESSURIZATION CONTROL PANEL



Airflow Indicator and Flow Sensor and Transmitter
Figure 1

AIRFLOW INDICATOR AND FLOW SENSOR AND TRANSMITTER - MAINTENANCE PRACTICES

1. Removal/Installation Airflow Indicator and Flow Sensor and Transmitter

NOTE: For removal of airflow indicator, refer to Chapter 21, INSTRUMENTS.

A. Remove Flow Sensor and Transmitter.

NOTE: Remove flight deck turbocompressor to gain access to flight deck flow sensor and transmitter (refer to 21-1-1, Maintenance Practices). It is not necessary to remove the cabin turbocompressor to gain access to the cabin flow sensor and transmitter.

(1) Open AIR FLOW IND circuit breaker.

(2) Disconnect electrical connector from flow sensor and transmitter. (Tag for installation.)

(3) Remove four screws securing flow sensor and transmitter to ducting.

(4) Remove flow sensor and transmitter.

CAUTION: COVER PROBE WITH PROTECTIVE CAP.

B. Install Flow Sensor and Transmitter.

(1) With gasket in place, position flow sensor and transmitter with probe extending into duct. (Direction of flow arrow on cover shall point forward.)

(2) Install four retaining screws. (Mounting screw holes in base plate are offset to prevent improper installation.)

(3) Connect electrical connector to receptacle on transmitter.

(4) Close AIR FLOW IND circuit breaker.

(5) Operate recirculation fan to check airflow indicator (refer to 21-0, Maintenance Practices).

2. Adjustment/Test Airflow Indicator

A. Equipment Required - Standard 28-volt dc output test unit containing current regulation and metering provisions from 0 to 100 microamperes.

B. Preparation.

(1) Remove airflow indicator (refer to Removal/Installation).

(2) Check airflow indicator pointers for zero position. Pointers shall indicate 20-pm (pounds per minute) air weight flow with no input signal applied to indicator.

(3) Adjust indicator pointers to obtain 20-pm reading as above. Adjustment screw is located at pivot point of each pointer on dial face.

NOTE: Adjustment must be made with indicator in its normal mounting position.

C. Perform Airflow Indicator Calibration Test.

(1) Connect airflow indicator to test unit as follows:

(a) Connect indicator pins B and D to negative 28-volt dc output terminal of test unit.

NOTE: In steps (b) and (c) following do not connect indicator pins A and C to test unit at the same time. Test cabin side of indicator first, then test flight deck side.

(b) Connect indicator pin A to positive 28-volt dc terminal of test unit to check cabin side of indicator.

(c) Adjust test unit to apply a microampere input to indicator to obtain a simulated airflow indication as given in Table I following. The microampere reading at each airflow indication must fall within the limits given.

TABLE I

AIRFLOW (pm) Cabin/Flight Deck	INPUT (microamperes)
20	0 +10 -0
30	25 (±8)
40	41 (±5)
60	61 (±3)
100	82 (±1)

(d) Repeat steps (b) and (c) above substituting pin C for pin A to check flight deck side of indicator.

(2) Replace indicator with new unit if requirements stated in preceeding table cannot be met.

3. Inspection/Check Airflow Indicator and Flow Sensor and Transmitter

A. Airflow Indicator.

(1) Check dial face for damage from moisture or dust.

(2) Check for broken dial glass.

(3) Check for electrical connector security and for worn insulation.

(4) Check that indicator retaining screws are secure.

B. Flow Sensor and Transmitter.

(1) Check probe for damage to resistance wires.

(2) Check electrical receptacle for damaged threads or pins.

(3) Check gasket seal.

4. Cleaning/Painting Airflow Indicator and Flow Sensor and Transmitter

A. Clean Airflow Indicator.

(1) Wipe indicator with a cloth moistened with solvent, Specification AMS 3160A.

NOTE: Do not immerse indicator in solvent.

B. Paint Airflow Indicator.

(1) Cover dial glass, name plate, and receptacle with masking tape.

(2) Remove corrosion with fine crocus cloth.

(3) Touch up or repaint with glyceryl phthalate enamel, Specification AMS 3120B using a small brush or spray.

(4) Allow to dry four hours before installation.

C. Clean Flow Sensor and Transmitter.

(1) Wipe oil and grease from surfaces of sensor/transmitter housing with a clean dry cloth.

CAUTION: DO NOT TOUCH OR WIPE PROBE.

(2) Clean probe by immersing it for five minutes in an ultrasonic cleaning bath filled with 2B alcohol.

NOTE: If ultrasonic cleaning equipment is not available, clean probe by immersing and agitating it in alcohol bath.

CAUTION: DO NOT IMMERSE SENSOR/TRANSMITTER HOUSING IN ALCOHOL. ALSO, DO NOT CLEAN PROBE WITH AIR PRESSURE, HEAT, OR SOLVENTS OTHER THAN ALCOHOL. ALLOW PROBE TO AIR-DRY AFTER CLEANING.

(3) Remove corrosion from sensor/transmitter housing with fine crocus cloth.

D. Paint Flow Sensor and Transmitter.

(1) Touch up damaged painted surfaces with heat resistant black enamel, Specification AMS 3120B.

FREON BACK PRESSURE CONTROL - DESCRIPTION AND OPERATION

1. Description

The back pressure control is mounted on top of the evaporator Freon outlet header near the aft frame of the Freon package. Two harness receptacles connect the back pressure control to the bellows control and the back pressure regulator valve. The control, shown in Figure 1, consists of a bridge circuit and a magnetic modulator between the bellows control transformer and the back pressure regulator valve. Both legs of the bridge contain equal rectifiers and resistors, and each leg is connected to opposite ends of a transformer coil. The rectifiers, resistors, transformer coil, magnetic modulator, and the amplifier are potted within the control housing.

2. Operation

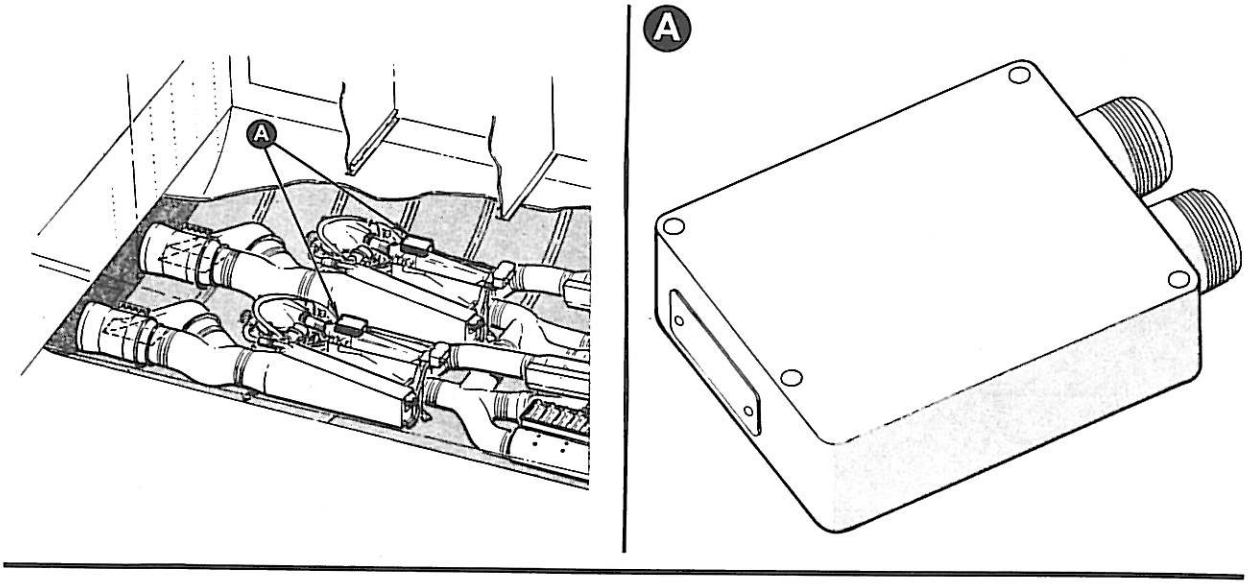
The back pressure control consists of the necessary circuitry to provide control of the back pressure regulator valve in response to signals from the bellows control and the current transformer. The bellows control provides the signal to the back pressure control for positioning the back pressure regulator valve to obtain the desired cooling capacity from the Freon package. A signal from the current transformer overrides the signal from the bellows control whenever the normal current load of the Freon compressor motor is exceeded. This signal to the back pressure control starts closing the back pressure regulator valve to reduce compressor load and consequently reduce compressor motor current. The back pressure control contains a power supply, transistor amplifier, and magnetic modulator.

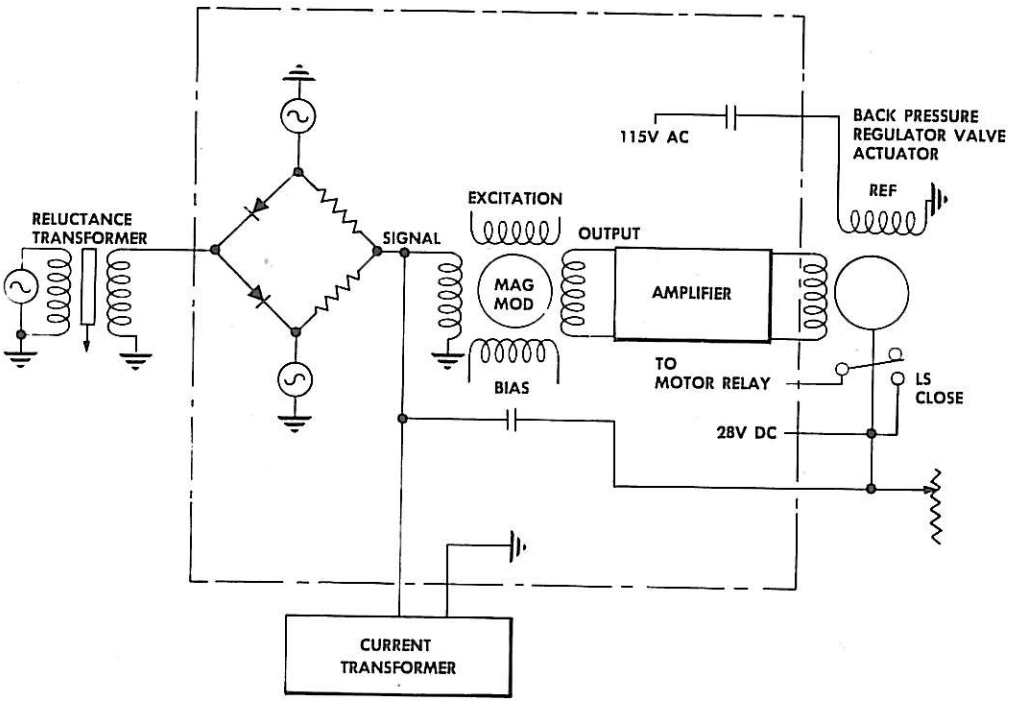
A. Magnetic Modulator.

The magnetic modulator contains input, output, bias, and excitation coils. An ac voltage is supplied to the excitation coil. This voltage is induced into the output winding provided the modulator is properly biased and properly supplied with a dc signal voltage. A dc current is applied through the bias coil to provide a modulator null voltage above ground. The dc input voltage (either plus or minus) will then shift the output ac signal by 180 degrees depending on whether the net magnetic modulator dc signal is above or below null. The level of the induced voltage from the excitation winding into the output winding is controlled by the current flow through the signal coil. The direction and amount of current flow through the signal winding will determine the phase and amplitude of the voltage from the output winding of the magnetic modulator.

B. Transistor Amplifier.

The output signal from the magnetic modulator is amplified by a two stage push-pull transistor amplifier. The transistors used are NPN





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Freon Back Pressure Control
Figure 1

type for the first stage and PNP type for the second stage. Circuit application of the transistors in both stages is "common emitter." The input signal is applied between base and emitter with the output generated between collector and emitter. The output of the amplifier is applied to the control phase winding of the back pressure regulator valve.

C. Phase Shifting.

The reluctance transformer in the bellows control is supplied with an ac voltage to its primary winding. The position of the transformer core determines the phase of the voltage obtained from the secondary windings. At the normal operating position of the bellows control (where the variable spring pressure equals evaporator pressure) the transformer is adjusted to be at null. Movement of the core above or below this null point provides the phase shifted voltage which is applied to the bridge detector circuit where the ac signal is rectified. The resultant voltage from across the bridge will be either positive or negative voltage depending on the phase voltage applied. The positive voltage results when the core of the reluctance transformer is lowered as when less cooling is scheduled. The resulting current flow through the signal coil of the magnetic modulator sets up a control phase voltage which closes the back pressure regulator valve. Conversely, when the core of the reluctance transformer is raised for increased Freon package cooling, a negative voltage results across the bridge detector. This voltage causes current flow through the signal coil of the magnetic modulator to set up a control phase voltage which closes the back pressure regulator valve.

D. Regulator Valve Actuator Speed Control.

To control the speed of the back pressure regulator valve actuator, the valve contains a rate feedback potentiometer. The movable contact of this potentiometer is capacitance coupled to the input coil of the magnetic modulator through a rectifier circuit. Full voltage is initially applied to the input coil of the magnetic modulator from the bridge detector. However, as the valve actuator starts to rotate, its potentiometer applies a voltage of opposite polarity to the input coil. This results in a regulation of its rate of travel, and permits maximum voltage to be applied to the valve actuator at the instant of start.

E. Limit Switch.

A circuit through the back pressure control connects the coil of the compressor motor power relay to a limit switch in the back pressure regulator valve. The limit switch completes a circuit for compressor starting, whenever the valve is in the closed position, that permits 28-volt dc power to be supplied to the compressor motor power relay.

A set of contacts on the compressor motor power relay shunts the valve limit switch once the relay has energized. Another contact set that closes whenever the compressor motor power relay is de-energized, applies 28-volt dc power to the signal coil of the magnetic modulator to close the back pressure regulator valve (when the compressor is shut down) by applying a closing signal to the control winding of the valve.

The output from the current transformer is rectified into a positive dc voltage and compared to a negative dc voltage. Whenever the current load of the compressor increases above a preset amount, the output positive voltage from the current transformer exceeds the negative comparison voltage. By means of a diode, this excessive positive voltage is applied to the input coil of the magnetic modulator to provide a signal to close the back pressure regulator valve and reduce compressor load at any time the current exceeds the maximum value allowed.

FREON BACK PRESSURE CONTROL - MAINTENANCE PRACTICES

1. Removal/Installation Freon Back Pressure Control (see Figure 201)

   A. Equipment Required - None.

   B. Preparation.

      (1) Open ELEC TEMP CONTROL and FREON SYS CONT circuit breakers (cabin or flight compartment as required).

      (2) Open Freon package access door (cabin or flight compartment as required).

   C. Remove Freon Back Pressure Control.

      (1) Locate Freon back pressure control; it is bracket-mounted on top aft end of Freon evaporator.

      (2) Disconnect tow electrical connectors from front end of control. (Cap connectors and receptacles. Tag for installation.)

      (3) Remove four bolts securing control to mounting bracket.

         NOTE: Raise bolts enough to clear mounting bracket, then slide control off bracket.

      (4) Remove Freon back pressure control.

   D. Install Freon Back Pressure Control.

      (1) Position control on mounting bracket with electrical connectors forward; large receptacle shall be on left side.

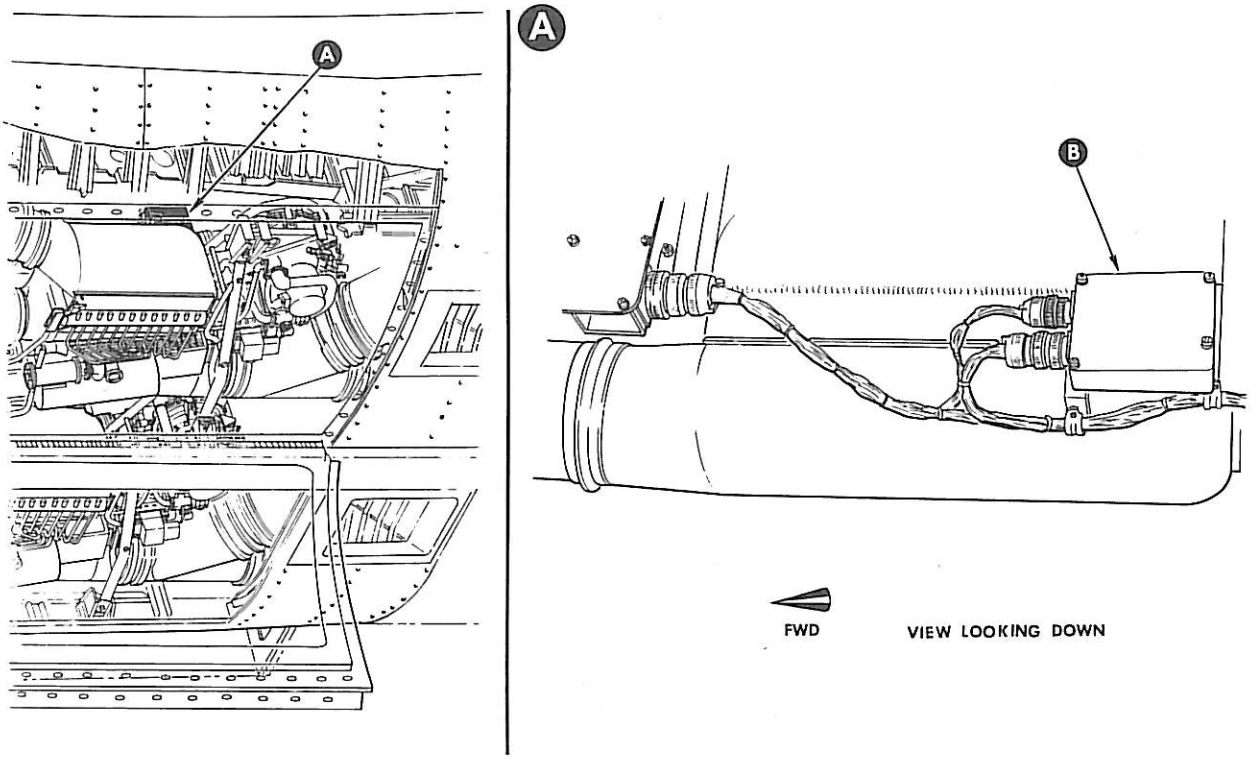
      (2) Insert four mounting bolts through top of control and mounting bracket; secure bolts with washers and nuts.

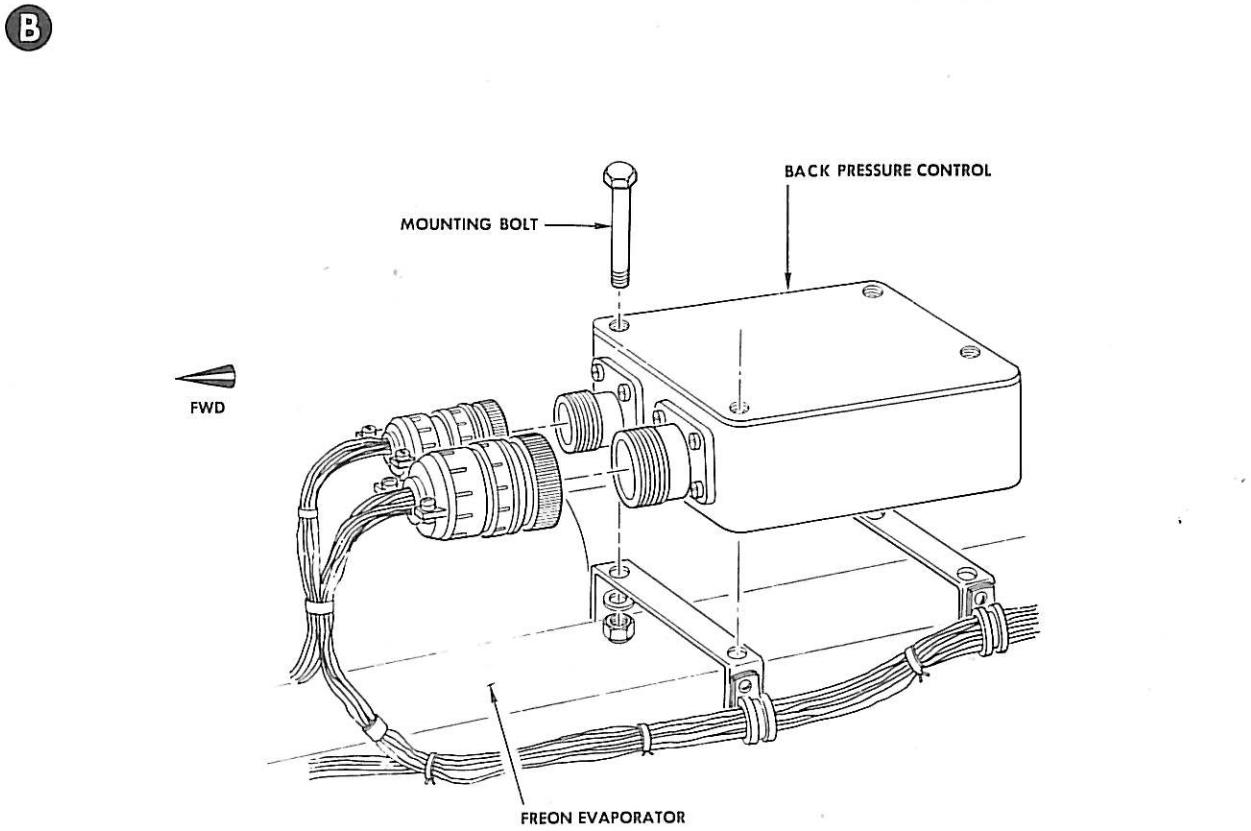
      (3) Connect electrical connectors to control.

      (4) Close ELEC TEMP CONTROL and FREON SYS CONT circuit breakers (cabin or flight compartment as required).

      (5) Perform operational check of air conditioning system (refer to 21-0, Maintenance Practices.)

      (6) Close Freon package access door.


A
B
FWD
VIEW LOOKING DOWN


B
BACK PRESSURE CONTROL
MOUNTING BOLT
FWD
FREON EVAPORATOR

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2. Adjustment/Test Freon Back Pressure Control

NOTE: To test back pressure control, use Hamilton Standard test set GS 1278. Refer to "Testing Procedures for CV 880 and CV 990 Air Conditioning System Maintenance with Hamilton Standard GS 1278 Test Set" in test set instruction manual.

3. Inspection/Check Freon Back Pressure Control

A. Check back pressure control.

(1) Examine exterior of control for damage to paint or cracks in potting material. Determine if cracks in potting have affected any electronic wiring, if so, replace control.

(2) Check electrical receptacles for distortion or other damage. Carefully straighten receptacle pins if bent.

(3) Check retaining screws for security.

4. Cleaning/Painting Freon Back Pressure Control

A. Clean back pressure control.

(1) Clean outer surfaces with lint-free cloth moistened with AMS 3160A solvent to remove grease or oil deposits.

NOTE: Do not immerse control in solvent, or allow solvent to enter receptacles.

B. Paint back pressure control.

(1) Mask off electrical receptacles and identification plate.

(2) Apply prime coat of zinc chromate, Specification AMS 3110, to metal surface to obtain semi-transparent greenish coating.

(3) Allow prime coat to dry 30 minutes at room temperature.

(4) Apply coat of glyceryl phthalate black enamel, Specification AMS 3120B.

(5) Allow to dry at room temperature for 4 hours before installation.

5. Approved Repair Freon Back Pressure Control

A. Remove corrosion from exposed metal surface and polish with crocus cloth.

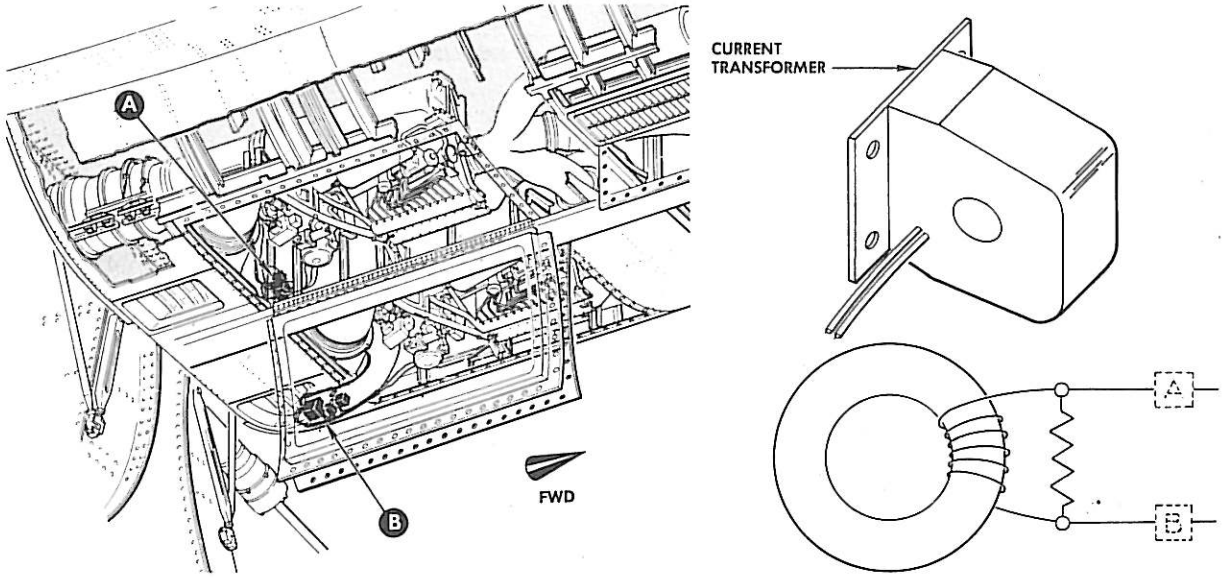
CURRENT TRANSFORMER - DESCRIPTION AND OPERATION

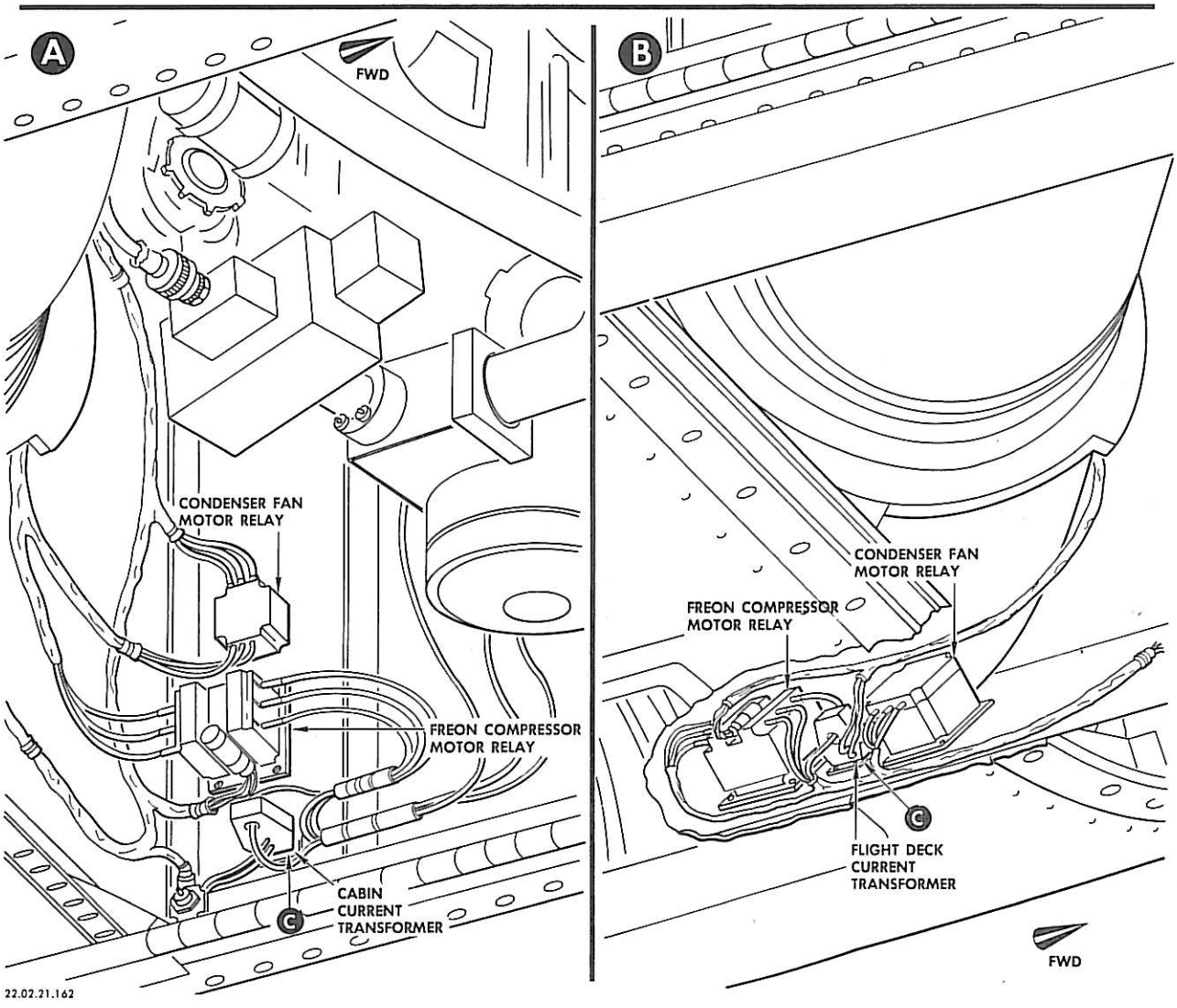
1. Description

The current transformer, shown on Figure 1, consists of a centrally bored box with mounting flanges on one end. Internally, an iron core encircles the hole. A coil connected to leads that protrude from the box is wrapped around the core. The flange has four holes which accommodate the mounting bolts to secure the box to the airplane structure.

2. Operation

A Freon compressor motor lead passes through the central bore. When current is used by the motor, an induced current flows from the coil. This current is proportional to the current supplied to the compressor motor. If compressor motor current becomes excessively high, the signal from the current transformer causes the Freon back pressure control to start closing the back pressure regulator valve, thereby reducing the back pressure in the main Freon loop. When the back pressure is reduced, the load on the compressor motor is reduced, and there is a corresponding reduction in compressor motor current.


A
B
FWD
CURRENT TRANSFORMER
A
B


A
FWD
CONDENSER FAN MOTOR RELAY
FREON COMPRESSOR MOTOR RELAY
C
CABIN CURRENT TRANSFORMER
B
CONDENSER FAN MOTOR RELAY
FREON COMPRESSOR MOTOR RELAY
C
FLIGHT DECK CURRENT TRANSFORMER
FWD
22.02.21.162

CURRENT TRANSFORMER - MAINTENANCE PRACTICES

1. Removal/Installation Current Transformer

A. Equipment Required - None.

B. Preparation.

(1) Open FREON SYS CONT circuit breaker (cabin or flight compartment as required).

WARNING: WHEN REMOVING CABIN (RH SIDE) CURRENT TRANSFORMER REMOVE THREE FREON COMPR AIR COND FUSES FROM NO. 2 ESS AC BUS.

WHEN REMOVING FLIGHT COMPARTMENT (LEFT SIDE) CURRENT TRANSFORMER, REMOVE THREE FREON COMPR AIR COND HTRS FUSES FROM NO. 4 NON ESS AC BUS.

DO NOT OPEN AC POWER DISTRIBUTION PANEL WITH BATTERY ON, ENGINES RUNNING, OR WITH EXTERNAL POWER CONNECTED TO AIRPLANE.

(2) Open Freon package access door (cabin or flight compartment as required).

C. Remove Current Transformer.

(1) Locate current transformer near aft left side of Freon package next to compressor motor relay. One power lead to compressor motor passes through core of current transformer.

(2) Disconnect small electrical leads from current transformer. (Tag for installation.)

(3) Disconnect compressor motor power lead which passes through current transformer.

(a) Unscrew terminal cap on compressor motor.

(b) Remove bolt which secures power lead to motor terminal.

(4) Remove four mounting screws which hold current transformer in position.

(5) Slide current transformer off end of power lead.

D. Install Current Transformer.

(1) Insert compressor motor power lead through hole in current transformer, and slide transformer up on wire to mounting position near compressor motor relay.

(2) Install four screws to secure transformer.

(3) Connect compressor motor power lead.

(a) With terminal cap on power lead, connect lead to motor terminal with bolt and nut.

(b) Slide terminal cap up to motor and screw in. Torque terminal cap from 100 to 150 inch-pounds and install safety wire.

(4) Connect two small leads to current transformer.

(5) Install fuses removed in step B.(1) and close FREON SYS CONT circuit breaker (cabin or flight compartment as required).

(6) Perform operational check of air conditioning system (refer to 21-0, Maintenance Practices).

(7) Close Freon package access door.

2. Adjustment/Test Current Transformer

A. Equipment Required.

(1) 500-volt dc megger.

(2) Ac vacuum tube voltmeter which is accurate within one percent.

(3) 400 (±20) cps power source with current adjustable from 50 to 100 (±1) amperes.

B. Preparation. Remove current transformer from airplane (refer to Removal/Installation).

C. Perform Dielectric Test of Transformer.

(1) Connect two transformer leads together.

(2) Connect one lead from megger to transformer leads connected in step (1); connect remaining lead from megger to transformer mounting base.

(3) A 500-volt dc megger check between transformer leads and mounting base shall indicate a minimum resistance of 10-megohms.

D. Perform Current Transformer Performance Test.

(1) Insert conductor from adjustable power source (capable of carrying 100-amperes) through center of transformer.

(2) Current in conductor shall be set to values given in Table following and shall develop corresponding secondary output voltages.

TABLE

Performance Test Limits

PRIMARY CURRENT Amperes (±1%) RPM	OUTPUT (SECONDARY) VOLTAGE Voltage (±0.1) RMS
100	9.86
88	8.67
76	7.49

(3) Replace current transformer with new unit if requirements stated in preceding Table cannot be met.

3. Inspection/Check Current Transformer

A. Examine exterior surfaces of transformer.

(1) Check for damage to wires and connections.

(2) Check mounting screws for security.

(3) Note any damage to compressor motor cable.

4. Cleaning/Painting Current Transformer

A. Clean transformer with cloth moisted with solvent, specification AMS 3160A.

(1) Remove corrosion with crocus cloth.

B. Paint Transformer.

(1) Touch up mounting flange if paint damage exposes metal. Use one coat of primer, Specification AMS 3110C and one coat of black enamel, Specification MIL-L-6805.

TEMPERATURE EQUALIZATION CONTROL SYSTEM - DESCRIPTION AND OPERATION

1. General

The temperature equalization control system consists of two inlet air sensors (anticipators), two discharge air sensors, a temperature differential control box, modulating power supply, ground modulating power supply, magnetic amplifier, and two dual electric cabin air heaters; see Figure 1 for component locations.

The temperature equalization control system maintains the temperature differential between the forward and aft cabin compartments within 2 degrees F (1.11 degrees C) of the scheduled temperature. This control is required because of different seating configurations within the cabin. These differences in seating arrangements are made possible by the movable cabin dividers which may be placed at any of five different locations in the cabin. A manual air shutoff valve is installed near each location to isolate the air supply to that portion of the cabin formed by the dividers. Sensors are located at one conditioned air inlet to each cabin compartment, and identical discharge air sensors are located at one air outlet for each compartment. The sensors transmit the air temperatures to the temperature equalization control box where they are compared. The control box then schedules the system to supply warmer air to the colder cabin compartment to equalize the temperatures. See Figure 2 for a block diagram of the control system. The temperature equalization system will operate at any temperature level once a stabilized temperature has been reached. The level of cabin temperature is controlled by the temperature control system. The temperature equalization control system is energized through actuation of the CABIN TEMP EQ CONT switch on the flight engineer's control panel.

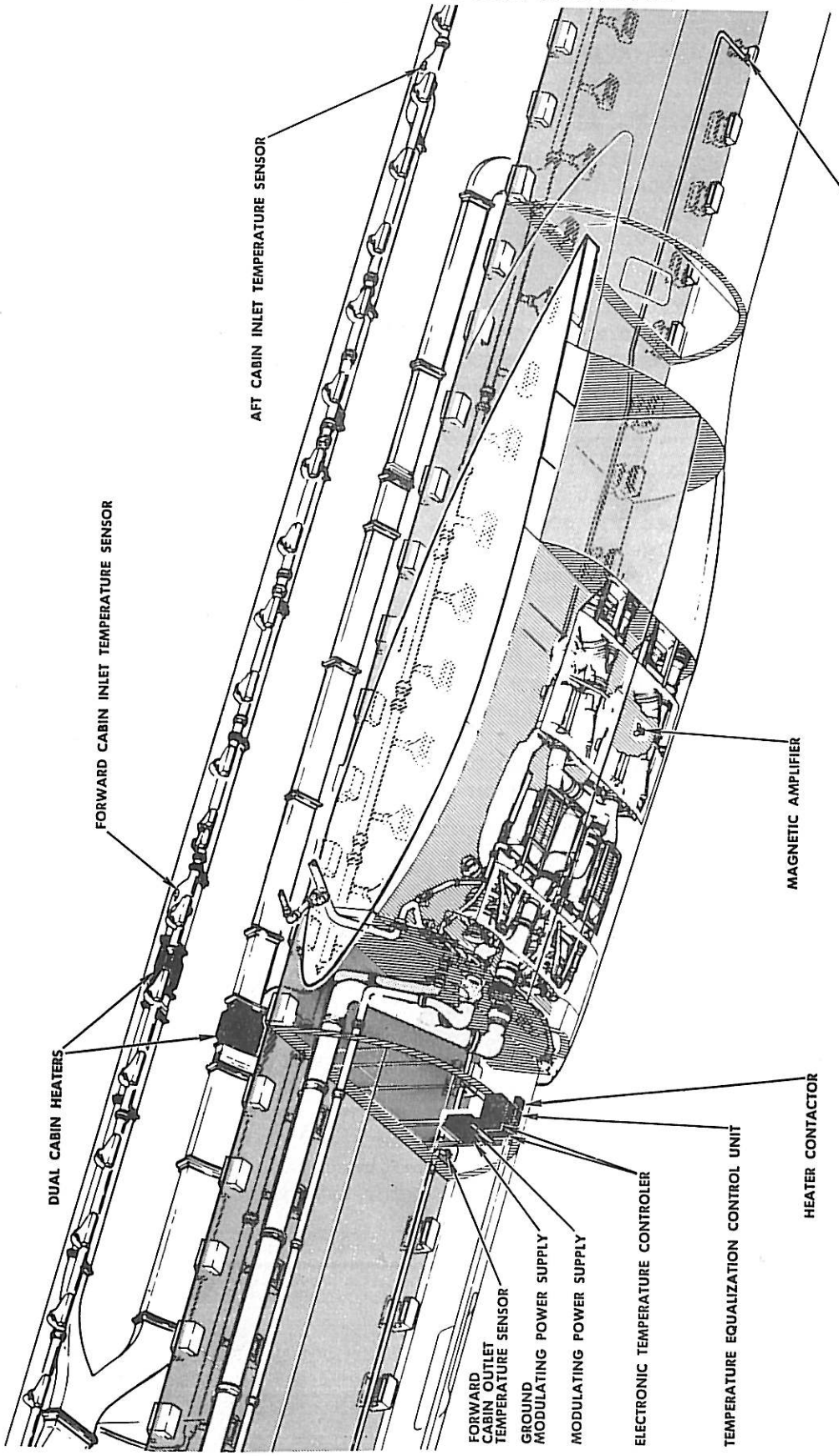
2. Operation

A. Inflight Heating.

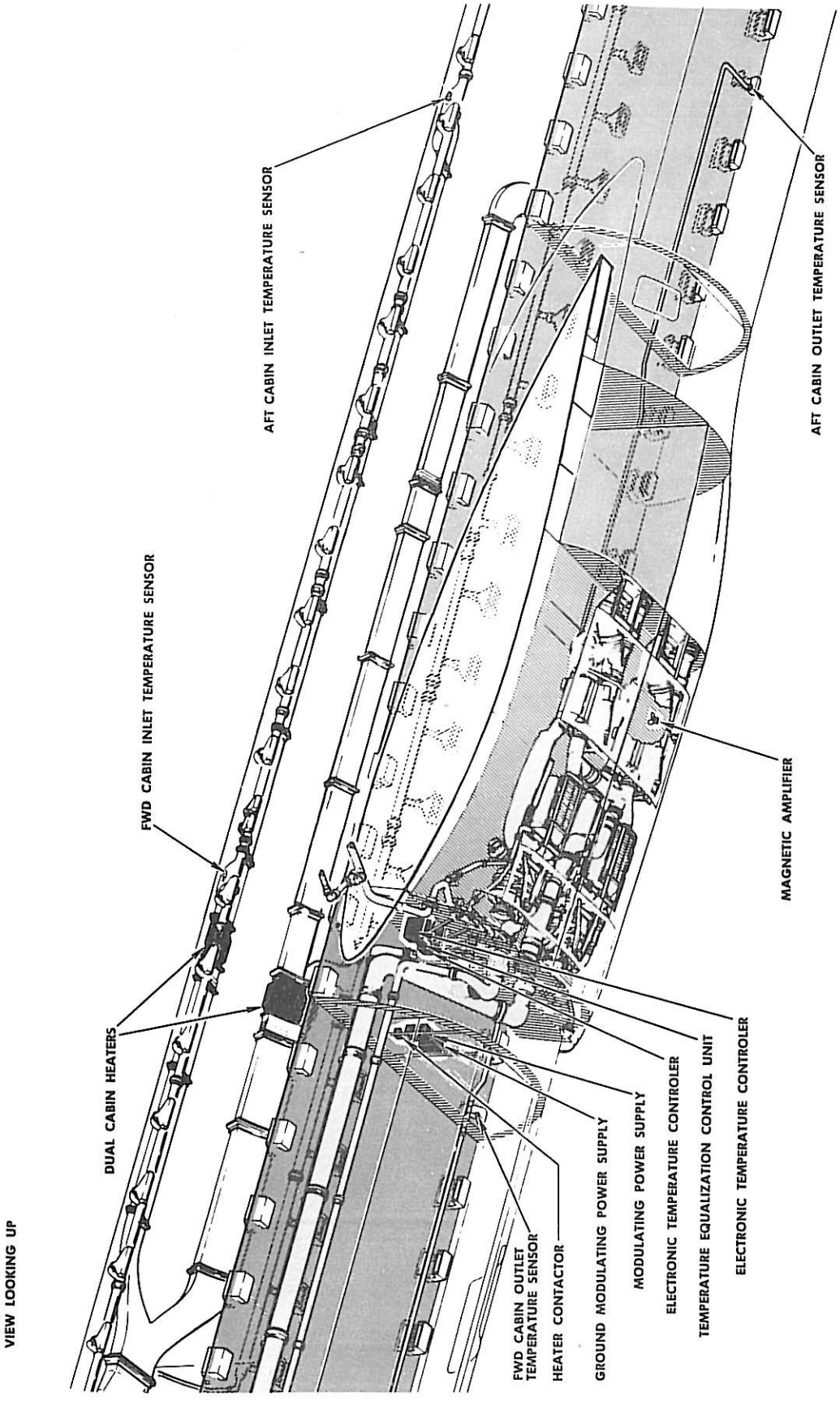
During the inflight heating schedule the sensors at the inlet and outlet of each cabin measure the temperature of the air passing around them. These sensors transmit this information to the temperature differential control unit where it is compared and a signal is transmitted to the magnetic amplifier to direct heating to the cooler of the two cabin areas until the temperature equalizes. Since the selected cabin temperature is controlled to a preset level by the temperature controller and the sensors in the temperature control system, the temperature equalization system will use this selected temperature as the mid-point for its equalization. See Figure 3 for a schematic of the temperature equalization system.

B. Ground Heating.

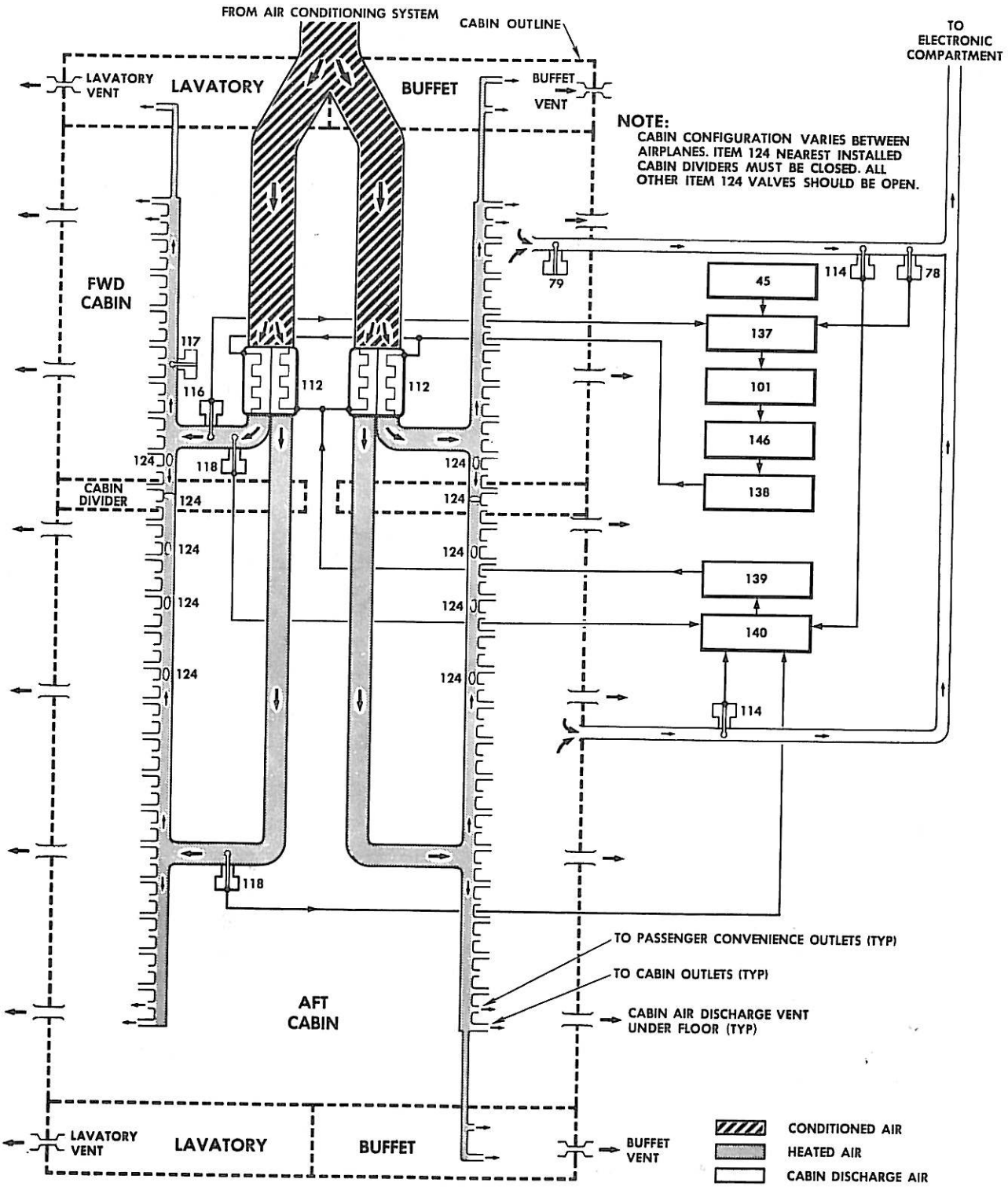
For ground operation, the turbocompressors are normally not operating and no heating is available from the turbocompressors, therefore the flight deck and cabin air electric heaters are utilized for heating. Heater operation for ground heating is controlled by the temperature



Temperature Equalization Control System Components
Applicable to Airplanes CV-7 Through CV-24
Figure 1 (Sheet 1 of 2)



Temperature Equalization Control System Components
Applicable to Airplanes CV-35 And On
Figure 1 (Sheet 2 of 2)



CODE:

45. TEMPERATURE SELECTOR
78. CONDITIONED AIR DISCHARGE TEMPERATURE SENSOR
79. CABIN AIR TEMPERATURE INDICATOR SENSOR
101. SEQUENCING DEVICE
112. CABIN AIR ELECTRIC DUAL HEATER
114. CONDITIONED AIR DISCHARGE TEMPERATURE (ΔT) SENSOR
116. CABIN AIR ANTICIPATOR INLET SENSOR
117. CABIN AIR MANUAL 160° LIMITER
118. CABIN AIR TEMPERATURE DIFFERENTIAL INLET SENSOR
124. CABIN AIR MANUAL SHUTOFF VALVE
137. CABIN ELECTRONIC TEMPERATURE CONTROLLER
138. GROUND MODULATING POWER SUPPLY
139. MODULATING POWER SUPPLY
140. TEMPERATURE EQUALIZATION CONTROL
146. MAGNETIC AMPLIFIER

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Temperature Equalization Control System
Block Diagram
Figure 2

selector, the electronic temperature controller and the sensors for that system located in the supply and discharge ducts. These units transmit a signal to the electronic temperature controller and if the temperature within the cabins is below that preset by the temperature selector, the electronic temperature controller programs heating through the sequencing device. The sequencing device also directs the magnetic amplifier to control the ground modulating power supply for the requisite heat to provide warm air to the cabins. The ground modulating power supply is capable of transmitting increasing increments of power to the heaters in six steps of 0.6-kilowatts each, and a final step of 3.5-kilowatts to bring the total power to the heaters to 7.5-kilowatts.

Once the selected temperature within the cabins have been reached, the temperature equalization system will maintain this equalization by adding heater power to maintain the cooler cabin at the same level as the other cabin within 2 degrees F (1.11 degrees C).

3. Cabin Dual Heaters

Two dual cabin heaters, shown on Figure 4, are installed in the cabin overhead ducts of the air conditioning system between stations 678 and 692. One section of each heater supplies the left and right ducts of the forward cabin and the other sections supply the left and right ducts of the aft cabin. Heating is accomplished by means of nichrome heating elements of the ungrounded "Y" configuration. The elements are capable of supplying from 75-watts to 7.5-kilowatts of heat.

Two thermal over-heat switches within the heater ducts will deactivate the 115-200 volt contactor to prevent the temperature of the heater duct from exceeding 130 degrees F.

4. Temperature Equalization Control

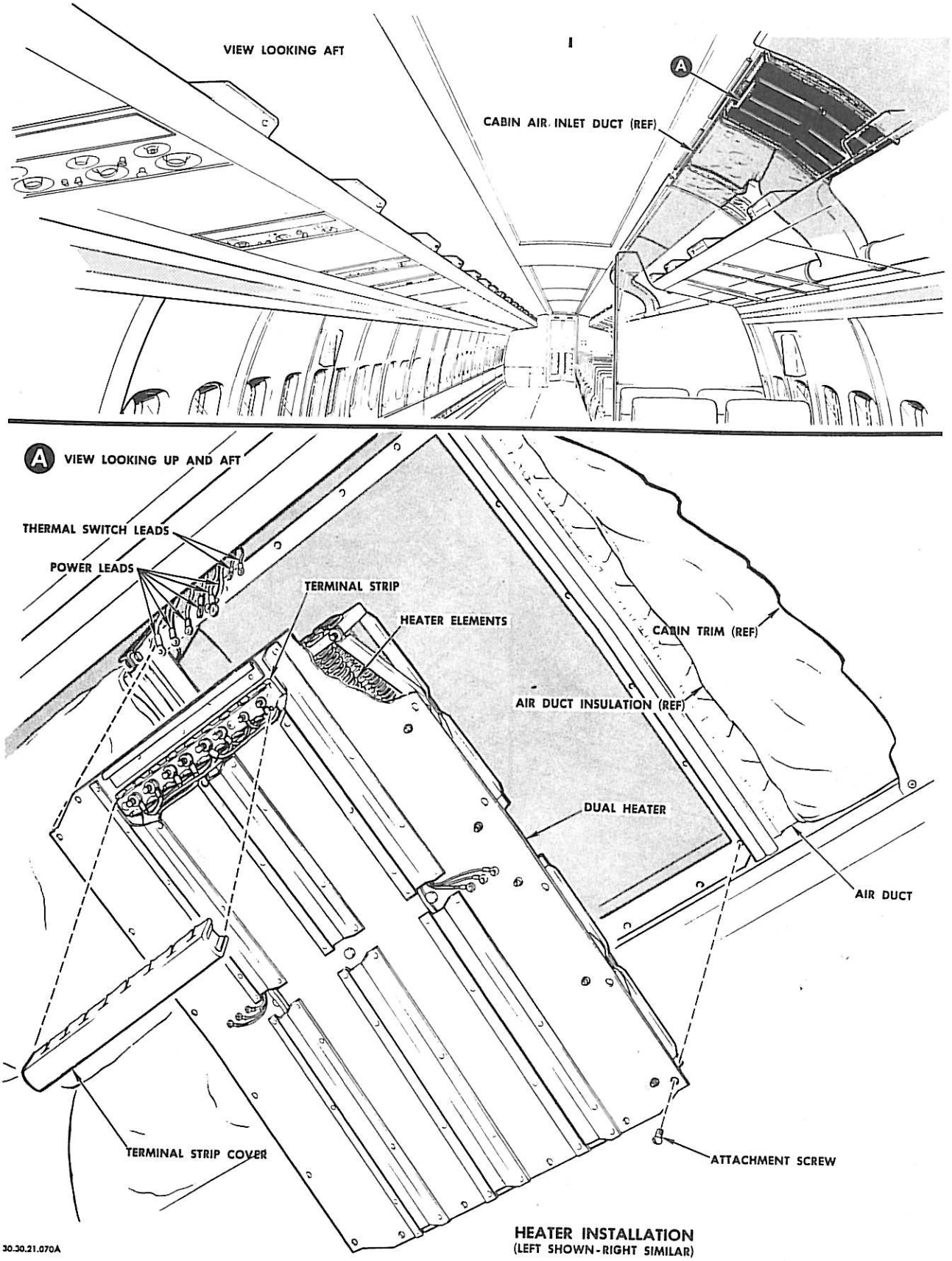
A. Description.

The temperature equalization control, shown on Figure 5, is located aft of the forward cargo compartment aft bulkhead. Access to the control is through the zipper panel which forms the cargo compartment aft bulkhead.

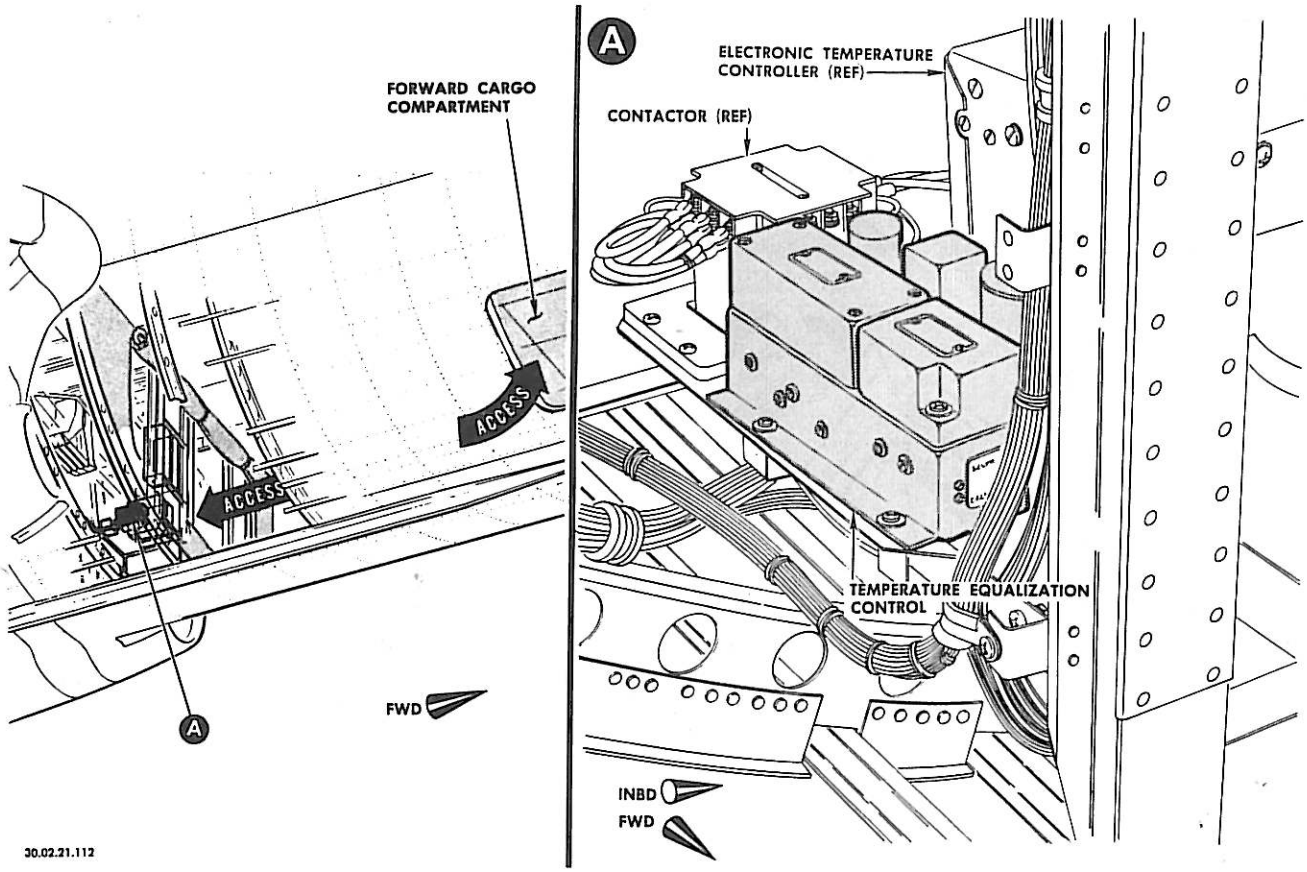
The control contains three reactors (magnetic amplifiers), a transfer relay and the associated circuitry.

B. Operation.

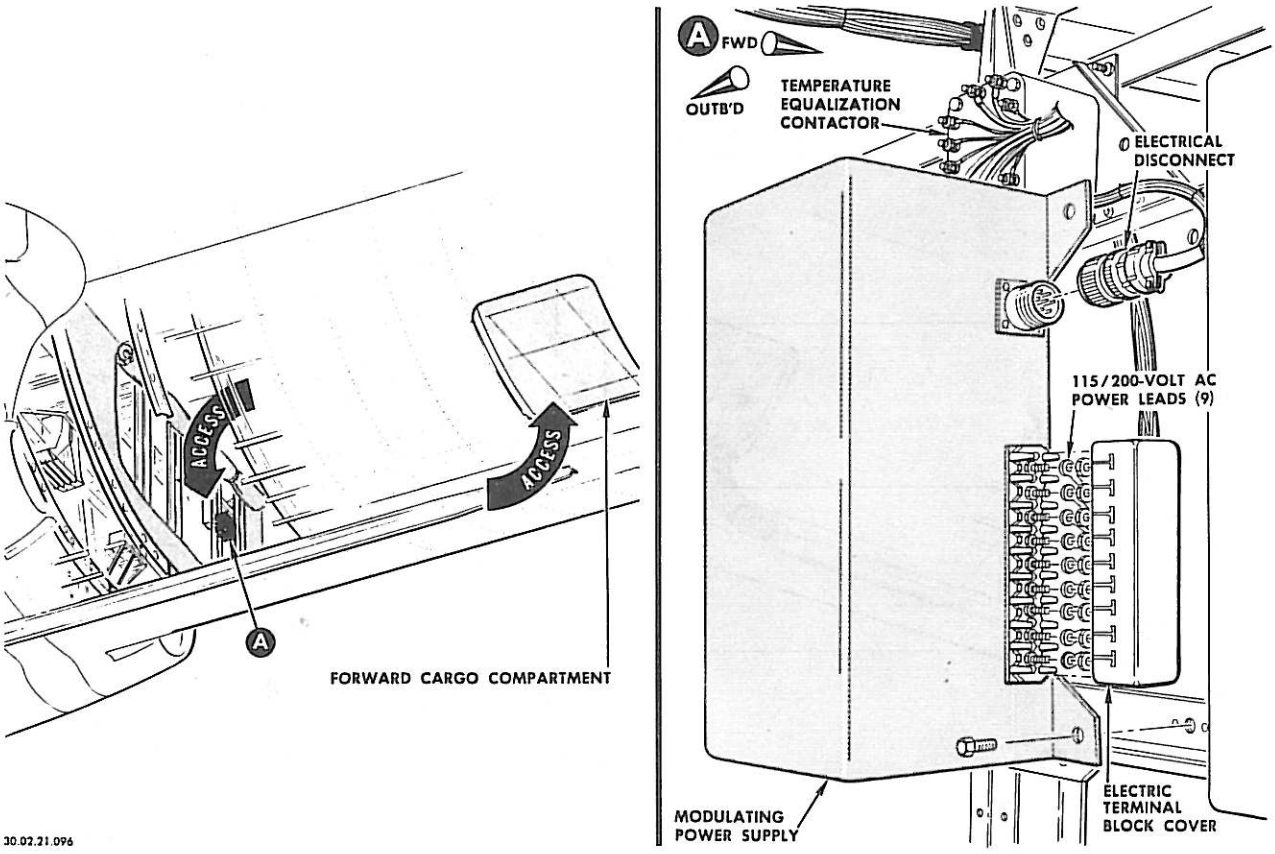
The control provides the means whereby the temperature signals transmitted from the forward and aft cabin sensors can be compared and differentiated to control or equalize the temperature between the cabins within 2 degrees F (1.11 degrees C) of each other. This is accomplished by a comparator bridge circuit which energizes a reactor to control the



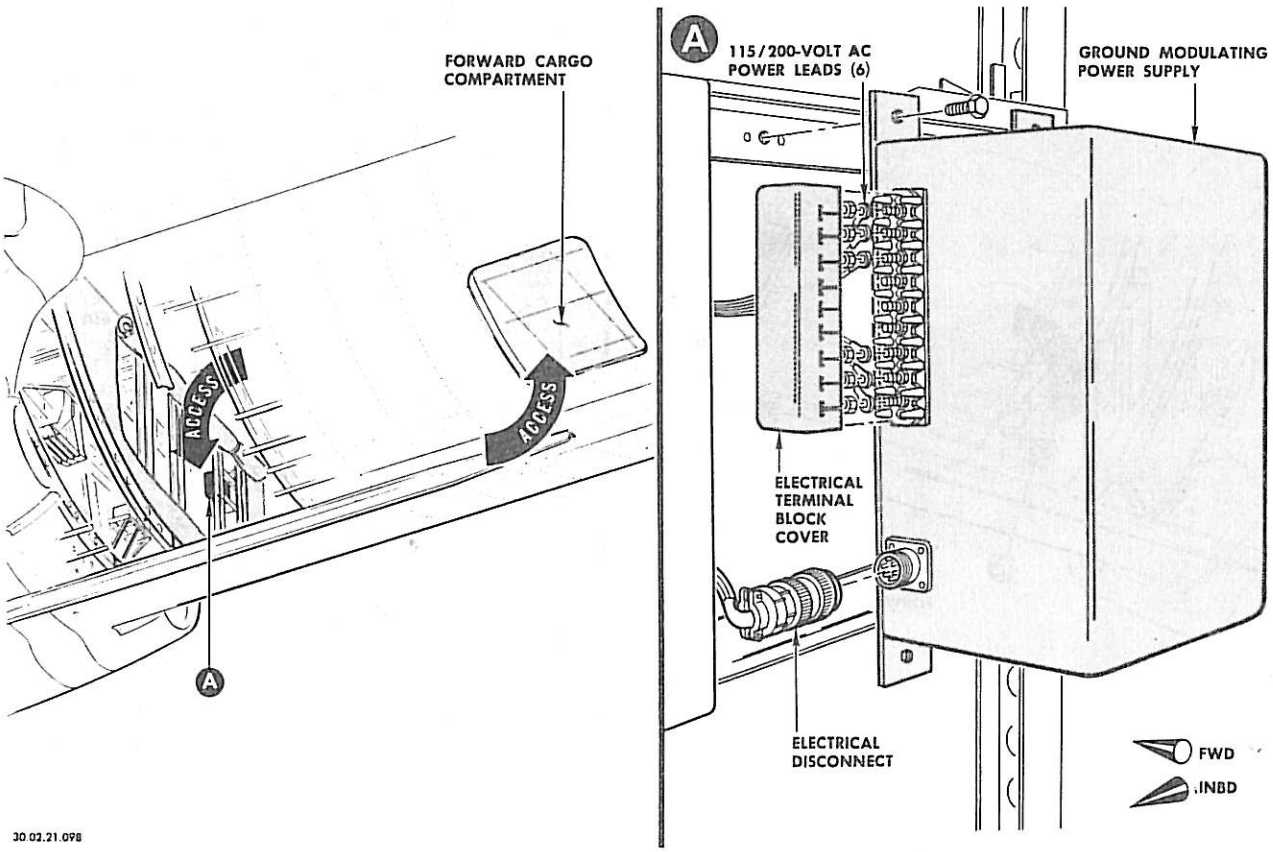
HEATER INSTALLATION
(LEFT SHOWN-RIGHT SIMILAR)



Temperature Equalization Control
Applicable to Airplanes CV-7 Through CV-24
Figure 5 (Sheet 1 of 2)

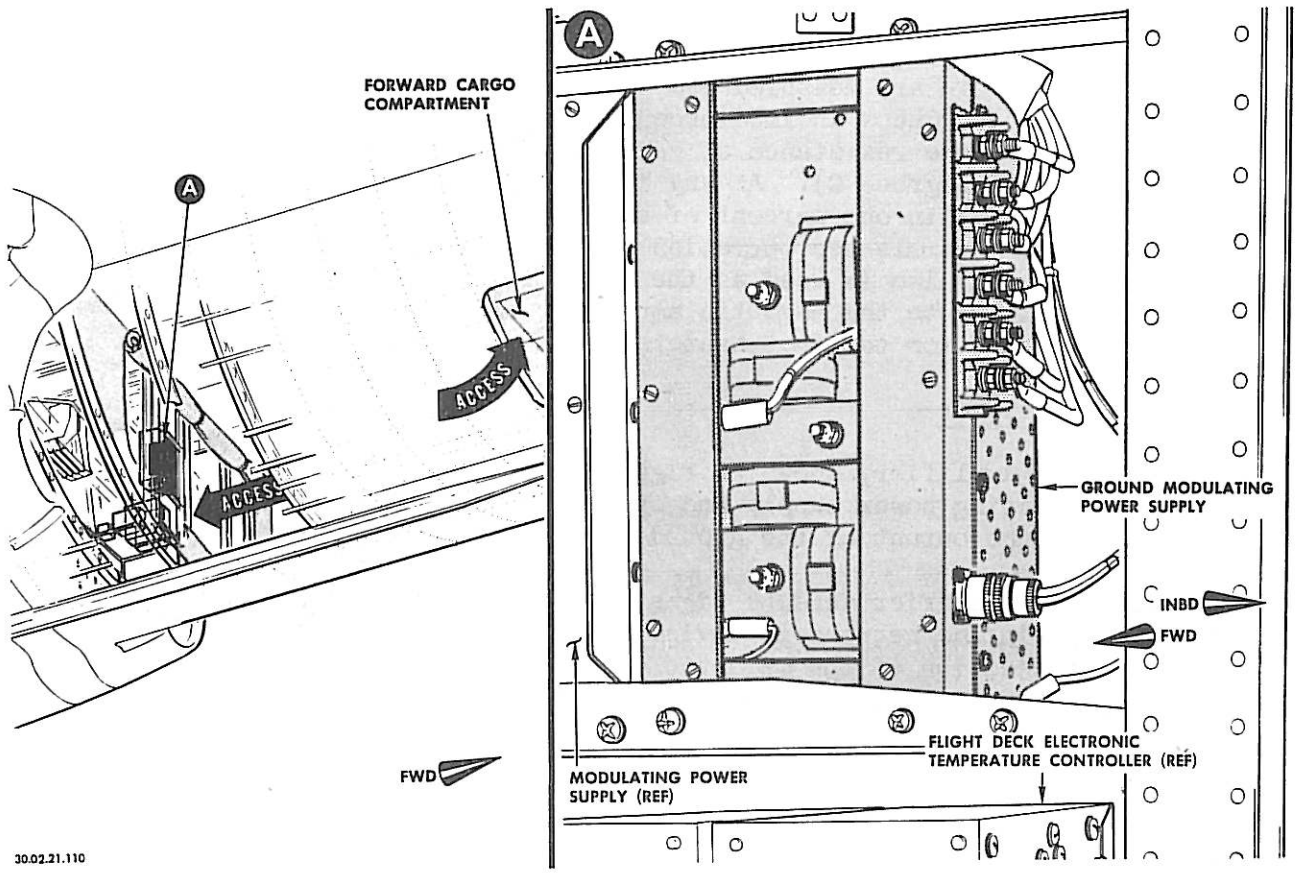


Temperature Equalization System Modulating Power Supply
Applicable to Airplanes CV-35 And On
Figure 6 (Sheet 2 of 2)



Temperature Equalization System Ground Modulating Power Supply

Applicable to Airplanes CV-35 And On
Figure 7 (Sheet 1 of 2)



Temperature Equalization System Ground Modulating Power Supply
Applicable to Airplanes CV-7 Through CV-24
Figure 7 (Sheet 2 of 2)

7. Temperature Sensors

A. Description.

Four identical temperature sensors are used in the temperature equalization control system. One each is located in the forward and aft cabin conditioned air inlet duct. These sensors (anticipators) are located downstream of the cabin heaters in the overhead ducts on the left side of the airplane at approximately stations 715 and 1135. One each is located in the air outlet duct above the floor level on the right side of the airplane at approximately stations 630 and 1046. The sensors in the outlet ducts are covered by an air vent cover plate (see Figure 8).

B. Operation.

The sensors are negative-resistance wire-wound resistors arranged in a balanced bridge circuit so that the inlet and outlet air temperatures for each cabin are measured and compared with each other. The resultant resistance produces an imbalance in the control circuit of a magnetic amplifier. The resistance of each sensor is 690-ohms (±1%) at 77 degrees F (25 degrees C). At any identical temperatures the sensors should be within one percent of each other. The output of the magnetic amplifier controls the operation of the K_1 relay. This temperature differential also is used as the control voltage to schedule the required output to the magnetic amplifier and thus control the heating requirements for the duct heaters.

8. Magnetic Amplifier

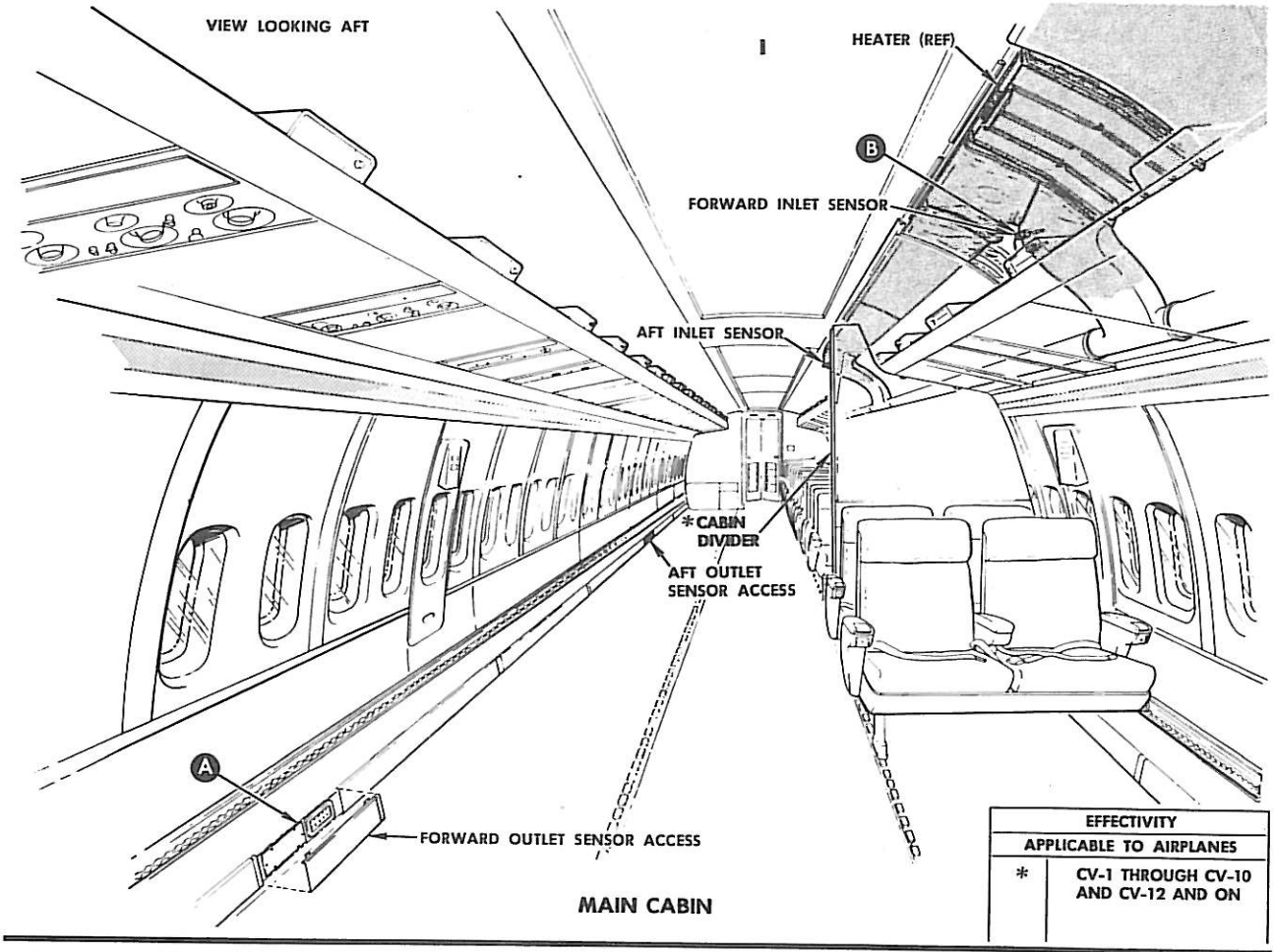
The magnetic amplifier, shown on Figure 9, acts as a pre-amplifier for the ground modulating power supply and operates only during ground operation to schedule the output of the ground modulating power supply.

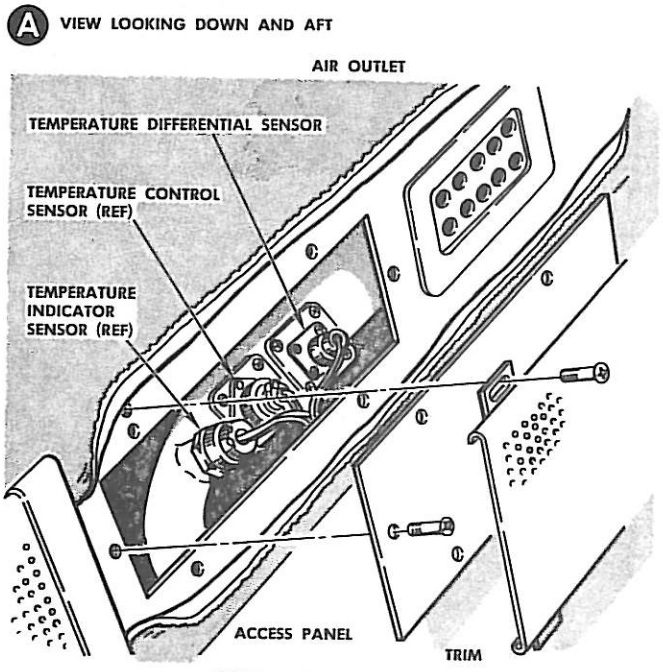
The magnetic amplifier accepts signals from the stepping switches operated by the cams in the sequencing device and through a voltage dividing network controls the action of the magnetic amplifier to provide power to the cabin heaters. The output of the magnetic amplifier supplies the power in seven increments to the ground modulating power supply. The basic excitation voltage to the magnetic amplifier is 115/200-volts ac.

The amplifier is located in the cabin Freon package compartment just above and outboard of the Freon compressor. An electrical harness connects the sequencing device to the amplifier.

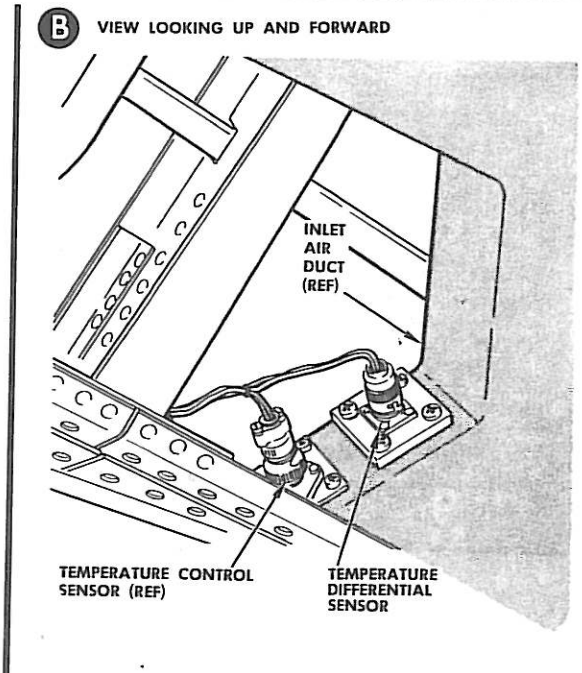
9. Manual Air Shutoff Valves

Ten manual air shutoff valves are located in the cabin air overhead supply ducts. The valves are installed opposite from each other, five each in





OUTLET SENSOR-
FORWARD SHOWN-AFT SIMILAR

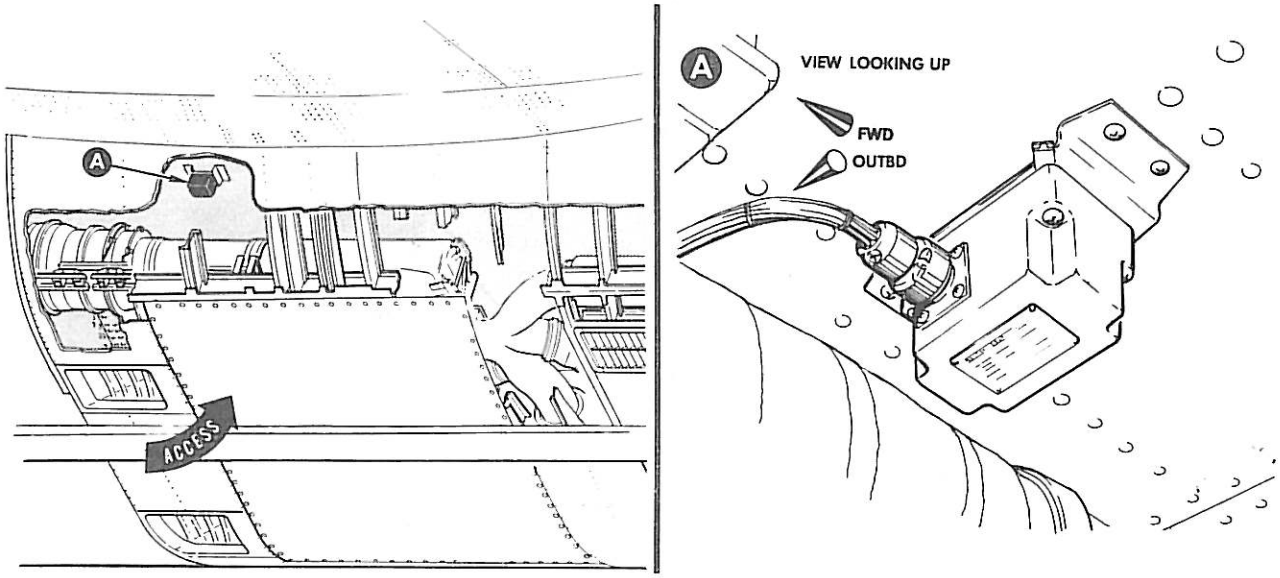


INLET SENSOR-
FORWARD SHOWN-AFT SIMILAR

the right and left ducts. They are manually-operated, open-closed type butterfly valves. A slot in the butterfly shaft enables the valves to be opened or closed with a screwdriver.

The valves are provided to isolate the air supply between the forward and aft cabin compartments which are formed by the installation of the movable cabin dividers. The dividers also serve as portable coat closets. A pair of valves is provided at each of the possible locations for the dividers.

Prior to the installation of the cabin dividers (closets), the shutoff valves nearest the dividers must be fully closed; the remaining valves on either side of the cabin must be open. Also, the air outlet between the closed shutoff valve and the divider must be covered prior to installing the divider. In the event the cabin dividers are not used, all valves (shown as V1 through V5 in Figure 10) must be open.



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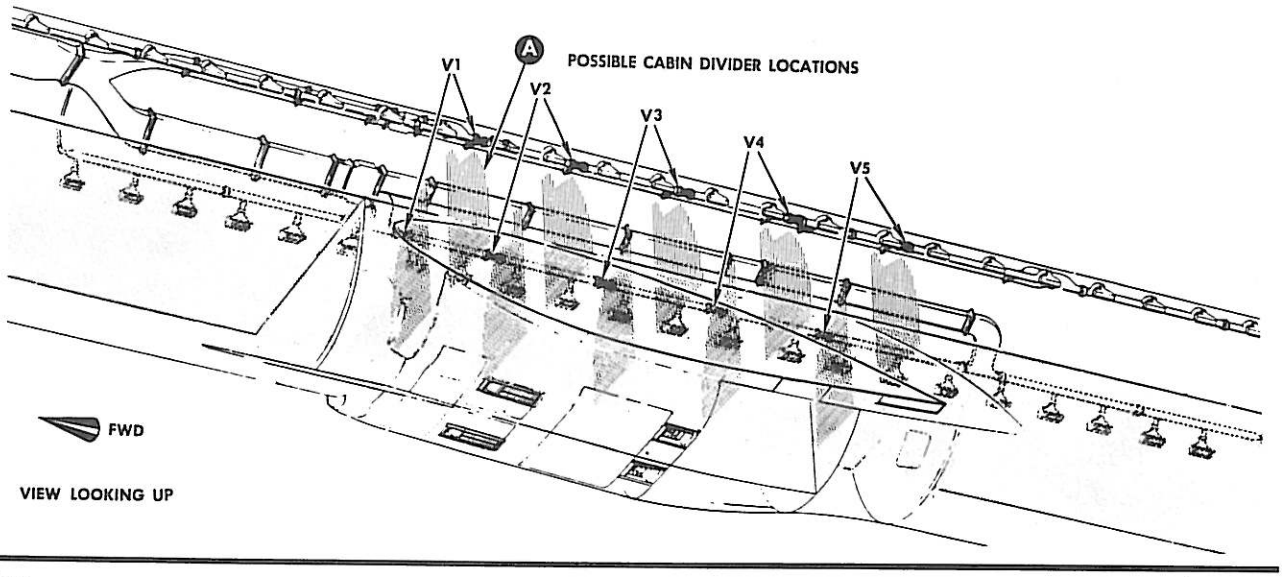
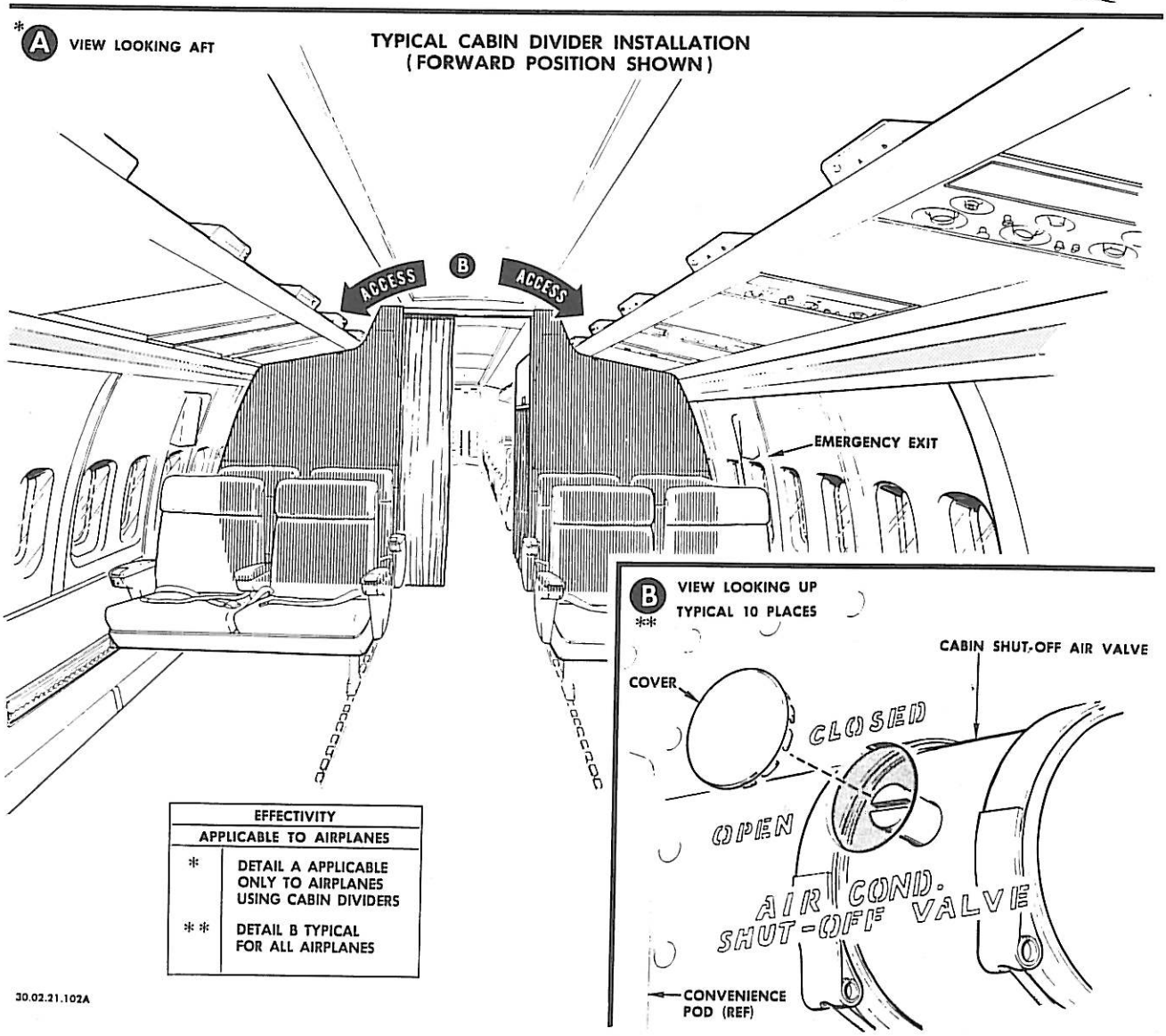

A POSSIBLE CABIN DIVIDER LOCATIONS
V1
V2
V3
V4
V5
FWD
VIEW LOOKING UP


*A VIEW LOOKING AFT
TYPICAL CABIN DIVIDER INSTALLATION
(FORWARD POSITION SHOWN)
B
ACCESS
ACCESS
EMERGENCY EXIT
B VIEW LOOKING UP
** TYPICAL 10 PLACES
CABIN SHUT-OFF AIR VALVE
COVER
CLOSED
OPEN
AIR COND. SHUT-OFF VALVE
CONVENIENCE POD (REF)
EFFECTIVITY
APPLICABLE TO AIRPLANES
* DETAIL A APPLICABLE ONLY TO AIRPLANES USING CABIN DIVIDERS
** DETAIL B TYPICAL FOR ALL AIRPLANES
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TEMPERATURE EQUALIZATION CONTROL SYSTEM - MAINTENANCE PRACTICES

1. Adjustment/Test - Temperature Equalization Control System Calibration Procedure

A. General.

The following calibration procedure shall be accomplished on the temperature equalization control system whenever a temperature sensor, or the temperature equalization control unit, is removed for repair or replacement. The test shall be performed only on airplanes which have all passenger seats and cabin dividers installed. All exterior doors, except the forward cargo compartment door, must be kept closed to prevent drafts. Drafts will prevent the temperature equalization control system from stabilizing.

B. Equipment Required.

(1) External source of 115/200 volt, 3-phase, 400 cps ac electrical power.

(2) Test harness, constructed per Figure 201, or equivalent.

(3) Two 15-110 degree F thermometers, accurately matched in the 60-85 degree range, and calibrated in 0.2 degree increments (Central Scientific Co. No. 19285-1 or equivalent).

(4) Small screwdriver.

(5) Headsets, microphones and sufficient extension cords (see Table) to maintain communication between flight compartment, forward cargo compartment and passenger cabin.

(6) Thread locking sealant, locktite, manufactured by the American Sealant Company, or equivalent.

Table No. 1

Test Station	Jack Location	Extension Cord (length in inches)*
Forward cargo compartment	Radio rack (electrical) and electronic compartment	365** 393***
Cabin aft discharge sensor	Flight engineer's station	965** 929***
Cabin aft discharge sensor	Navigator's station Observer's station	364**** 373*****
Flight compartment	Copilot's station	(use copilot's equipment)

*Extension cord lengths equal station-to-station dimensions plus 24 inches.
**Applicable to airplanes CV-1 through CV-25 and CV-35 and on.
***Applicable to airplanes CV-26 through CV-34.
****Applicable to airplanes CV-26 and on.
*****Applicable to airplanes CV-1 through CV-25.

C. Preparation.

(1) Disconnect electrical connector from temperature equalization control unit and connect test harness between airplane harness and control unit. Temperature equalization control unit is at aft end of forward cargo compartment on vertical mounting rack.

(2) Establish communication with areas involved in test through flight interphone system as follows:

(a) Close all audio selector panel circuit breakers.

(b) Place microphone selector and receiver switches at each audio selector panel in "interphone on" position. *Ascertain that EMER-NORM switch is in NORM position.

(c) Connect microphones and headsets, with extension cords, into jack location for each test station per Table No. 1.

NOTE: In order to establish communication with the forward cargo compartment, route extension cord from test station in compartment through left side overhead access (zipper panel) to jack location in electrical and electronic equipment compartment. An alternate method of routing extension cord from cargo compartment is out the compartment door and through the electrical and electronic compartment exterior access door. When alternate routing is used, the in-flight access door to the electrical and electronic compartment must be closed.

(3) Connect and apply external electrical power (refer to Chapter 24, ELECTRICAL POWER).

(4) Close the following circuit breakers:

(a) ELEC COMPT FAN CONT.

(b) CABIN ELEC TEMP CONT.

(c) RECIRC FAN CONT.

(d) CABIN TEMP EQUALIZER CONT AC.

(e) CABIN FREON CONT.

**(5) Ascertain that the following circuit breakers are open:

(a) GND MOD CONT.

*Applicable to airplanes CV-26 through CV-34.
**Applicable to airplanes CV-1 through CV-25 and CV-35 and on.

(b) GRD HEATER CONT.

(c) FLT DECK HEATER CONT.

(6) Place the following switches on flight engineer's control panel in positions indicated:

(a) CABIN TEMP EQ CONT - OFF.

(b) ELEC EQUIP COOL FAN - ON.

(c) Cabin temperature control AUTO-OFF-MAN - AUTO or MAN.

(d) RECIRCULATING BLOWER - MAN.

(e) FREON MASTER ON-OFF - ON.

(f) CABIN and FLIGHT DECK TEMP CONTROL selectors - mid-position.

(7) With recirculation fan operating, allow temperature within airplane to stabilize for a minimum of 30 minutes.

NOTE: Temperature shall not be considered stabilized until temperature between forward and aft cabin exhaust outlets (station 630 and 1046 temperature sensor outlets) is constant and temperature at each location has remained constant for a minimum of two minutes.

D. Calibration Procedure.

(1) With temperature stabilized per step C. (7) measure temperature differential between forward and aft cabin exhaust outlets; determine at which outlet the air temperature is coldest.

NOTE: When measuring temperature with precision thermometer hold thermometer at extreme end opposite from bulb. Place bulb end as close as possible to exhaust outlet without touching outlet screen. Hold thermometer as steady as possible.

(2) Adjust test harness potentiometer as follows:

(a) Set forward and aft potentiometers at their full counterclockwise positions.

(b) Turn potentiometer adjustment control for colder cabin (forward or aft) clockwise the number of turns equal to the difference in temperature between the forward and aft cabin (one turn on potentiometer equals one ohm; one ohm equals one degree fahrenheit).

(3) Place CABIN TEMP EQ CONT switch on flight engineer's control panel in ON position.

NOTE: Do not impose any electrical loads on the AC ESS BUS during the following steps as proper adjustment is dependent upon correct interpretation of voltmeter flicker.

(4) Immediately after switching CABIN TEMP EQ CONT switch ON, make the following adjustments on the temperature equalization control unit balance potentiometer. Adjustment must be made within one minute from time CABIN TEMP EQ CONT switch is turned ON.

(a) Turn control unit balance potentiometer adjustment control clockwise until voltmeter flickers; note position of adjustment control at point of meter flicker.

NOTE: If the temperature equalization control unit is in the proportional deadband (null point) and near point of relay actuation, the voltmeter will indicate approximately two to three volts and the relay should actuate with approximately one turn of the balance potentiometer adjustment control; the voltmeter should flicker when the relay actuates. If the control unit is not near the point of relay actuation, the voltmeter may indicate as high as 75 volts and more than one turn on the balance potentiometer may be necessary to cause meter flicker (relay actuation). Although a definite click may be heard from the relay, do not depend on hearing the click as it may not be audible due to surrounding noises; use meter flicker as proof of relay actuation.

(b) Turn control unit balance potentiometer adjustment control counterclockwise until the same result is obtained (meter flicker); note position of adjustment control at point of meter flicker.

(c) Set control unit balance potentiometer adjustment control midway between the two positions established above.

NOTE: If step (4) is not accomplished within one minute after switching CABIN TEMP EQ CONT switch ON, place switch in OFF position and wait 10 minutes, then repeat steps (3) and (4).

(5) Place CABIN TEMP EQ CONT switch in OFF position.

(6) Disconnect test harness and connect airplane harness to temperature equalization control unit.

(7) Take several temperature readings at forward and aft cabin exhust outlets.

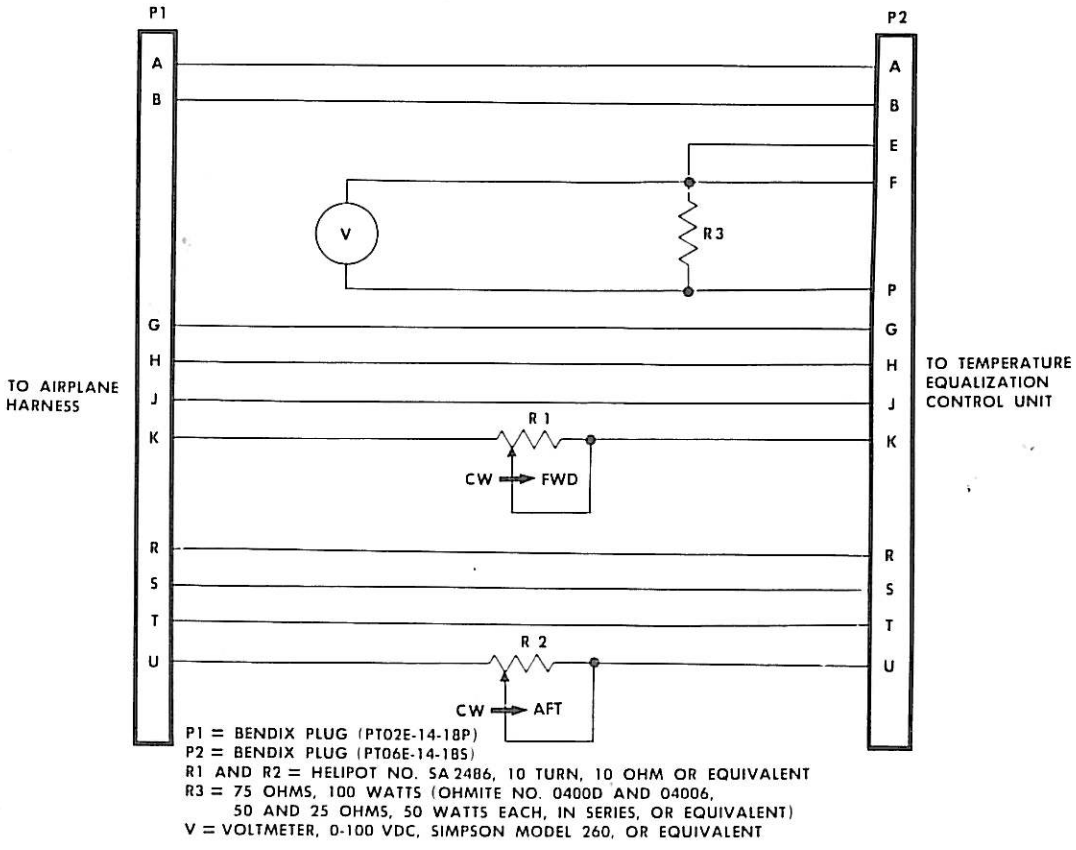
NOTE: Temperature readings must be taken within 30 minutes after placing CABIN TEMP EQ CONT switch in ON position.

(a) Temperature differential between forward and aft exhaust outlets shall be two degrees F maximum.

(b) Temperature stabilization shall be affected by the temperature increasing at the colder exhaust outlet, rather than cooling at the hotter outlet. The decrease in temperature differential shall be noticeable within approximately ten minutes.

(8) When balance potentiometer adjustment is complete and test results are satisfactory, seal balance potentiometer shaft with locktite to prevent movement due to vibration.

(9) When calibration is satisfactory, remove test equipment and restore airplane to normal configuration.



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Temperature Equalization System
Calibration Test Harness
Figure 201

TEMPORARY REVISION NO. 21-18.

Insert facing 21-6-0, Page 1, dated Nov. 15/62 (or subsequent).

The information in this temporary revision is applicable to airplanes not modified per Convair Service Bulletin 24-5. For airplanes that have been modified per Convair Service Bulletin 24-5, use the information on Page 1.

Retain this temporary revision in your manual until applicable airplanes have been modified per noted service bulletin.

Page 1, delete third (last) paragraph and substitute the following:

> The emergency pressurization shutoff valves are normally closed. They are opened by placing the PRESS SOURCE switches in the OPEN position. When placed in the OPEN position, the switches route 28-volt dc power from the 28-volt dc essential bus to the emergency pressurization shutoff valves, thus opening the valves and allowing bleed air to flow into the air conditioning system.

TEMPORARY REVISION NO. 21-19.

Insert facing 21-6-0, Page 3, dated Nov. 15/62 (or subsequent).

The information in this temporary revision is applicable to airplanes not modified per Convair Service Bulletin 24-5. For airplanes modified per Convair Service Bulletin 24-5, use the information on Page 3.

Retain this temporary revision in your manual until applicable airplanes have been modified per noted service bulletin.

Page 3, at lower left corner of art, both the CABIN and FLIGHT DECK EMERGENCY PRESSURE circuit breakers should be shown connected to the 28V DC ESS BUS.

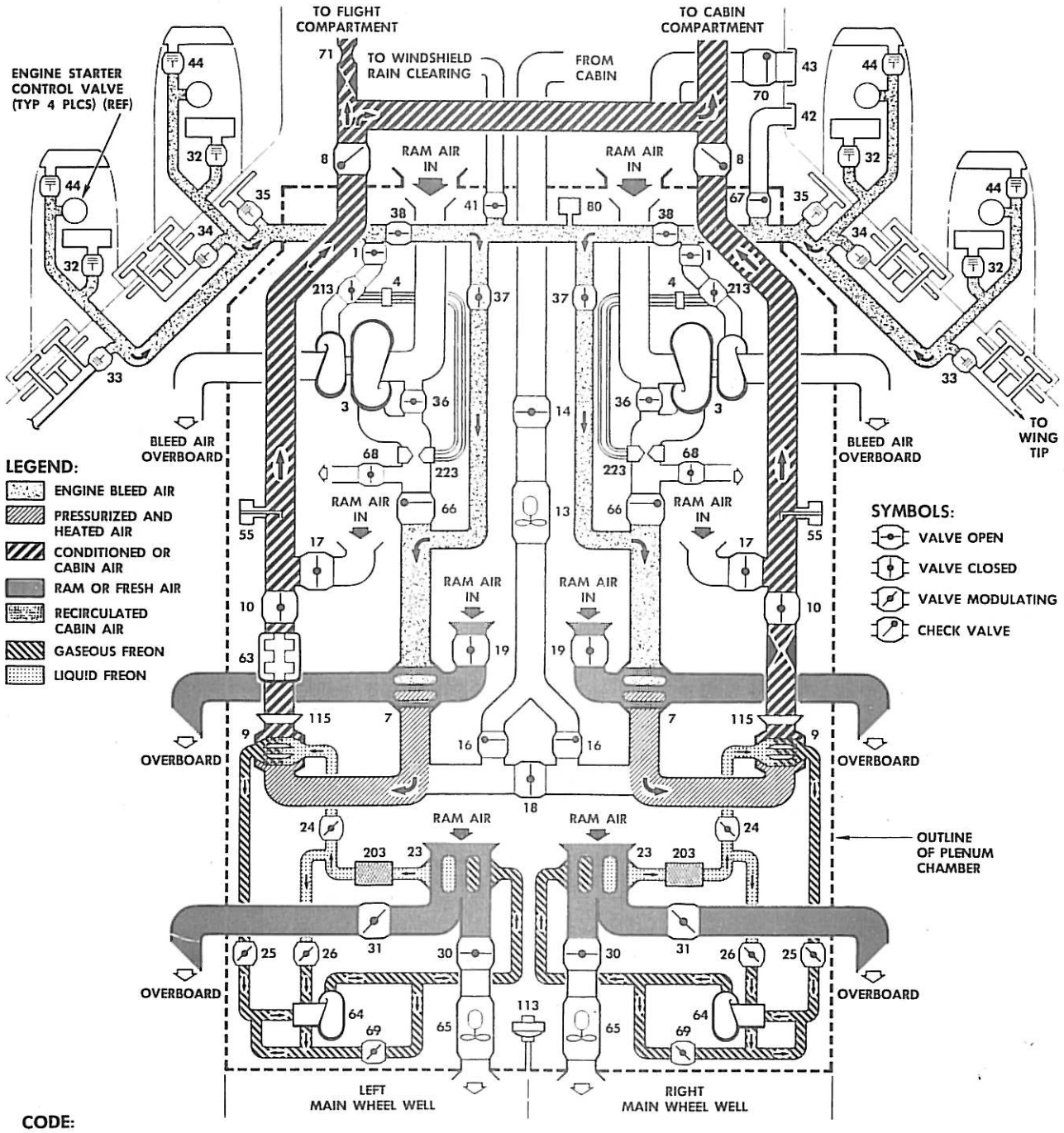
EMERGENCY PRESSURIZATION - DESCRIPTION AND OPERATION

1. General

Should both the flight deck and cabin turbocompressors malfunction at an altitude necessitating pressurization, engine bleed air can be utilized for emergency pressurization. The bleed air system will provide a total airflow of 80 pounds per minute, conditioned to a temperature comparable to the normal temperature of conditioned air.

When emergency pressurization is required, the turbocompressor shutoff valves for both the cabin and flight compartment pressurization systems are closed and both emergency pressurization shutoff valves are opened(see Figure 1). Bleed air enters the air conditioning system through the emergency pressurization shutoff valves and is ducted directly to the air-to-air heat exchanger and Freon evaporator for primary and secondary cooling as required by the temperature control system. Check valves prevent bleed air from entering the compressor section of the turbocompressor and the recirculation fan housing. The emergency pressurization system should not be operated continuously for more than 15 seconds while the airplane is on the ground. This restriction is required because there is no ram air to cool the air-to-air heat exchanger, and the hot bleed air will soon cause overheating of the Freon evaporator.

The emergency pressurization shutoff valves are normally closed. They are opened by placing the PRESS SOURCE switches in the OPEN position. When placed in the OPEN position, the switches route 28-volt dc power (see Figure 2) from their respective power buses to the emergency pressurization shutoff valves, thus opening the valves and allowing bleed air to flow into the air conditioning system. The cabin valve receives power from the 28-volt dc emergency bus, and the flight deck valve receives power from the 28-volt dc essential bus. This arrangement provides a safety factor in case either of the buses should fail. Should one bus fail, the other will provide power to operate its respective emergency pressurization shutoff valve.



CODE:

1. TURBOCOMPRESSOR SHUTOFF VALVE
3. TURBOCOMPRESSOR
4. TURBOCOMPRESSOR FLOW CONTROL
7. HEAT EXCHANGER
8. CONDITIONED AIR CHECK VALVE
9. FREON EVAPORATOR
10. CONDITIONED AIR EMERGENCY SHUTOFF VALVE
13. RECIRCULATION FAN
14. RECIRCULATION CONTROL VALVE
16. RECIRCULATION AIR CHECK VALVE
17. RAM AIR SHUTOFF VALVE
18. CROSSOVER SHUTOFF VALVE
19. HEAT EXCHANGER COOLING AIR MODULATING VALVE
23. FREON CONDENSER
24. FREON EXPANSION VALVE
25. BACK PRESSURE REGULATOR VALVE
26. MOTOR COOLING EXPANSION VALVE
30. CONDENSER GROUND COOLING AIR SHUTOFF VALVE
31. CONDENSER COOLING AIR MODULATING VALVE
32. ENGINE BLEED AIR VALVE
33. OUTBOARD LEADING EDGE ANTI-ICING VALVE
34. MIDSECTION LEADING EDGE ANTI-ICING VALVE
35. INBOARD LEADING EDGE ANTI-ICING VALVE
36. HEAT CONTROL MODULATING VALVE
37. EMERGENCY CABIN AIR FLOW VALVE
38. BLEED AIR EMERGENCY WING ISOLATION VALVE
41. WINDSHIELD RAIN REMOVAL VALVE
42. ENGINE START AIR CONNECTION
43. GROUND AIR CONDITIONING CONNECTION
44. ENGINE INLET DUCT LIP ANTI-ICING VALVE
55. AIR FLOW SENSOR AND TRANSMITTER
63. ELECTRIC HEATER—FLIGHT DECK
64. FREON COMPRESSOR
65. CONDENSER FAN
66. TURBOCOMPRESSOR CHECK VALVE
67. ENGINE START CHECK VALVE
68. TURBOCOMPRESSOR SURGE VALVE
69. FREON COMPRESSOR SURGE VALVE
70. GROUND AIR CONDITIONING CHECK VALVE
71. FLIGHT COMPARTMENT AIRFLOW LIMITER
80. BLEED AIR OVERPRESSURE SWITCH
113. PLENUM CHAMBER PRESSURE SWITCH
115. WATER SEPARATOR
203. FREON DRIER AND STRAINER
213. NOZZLE ACTUATOR
223. VENTURI DUCT

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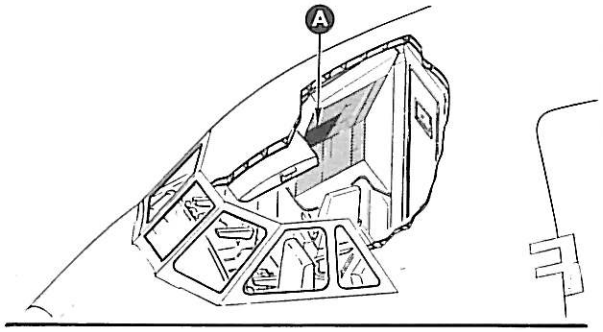
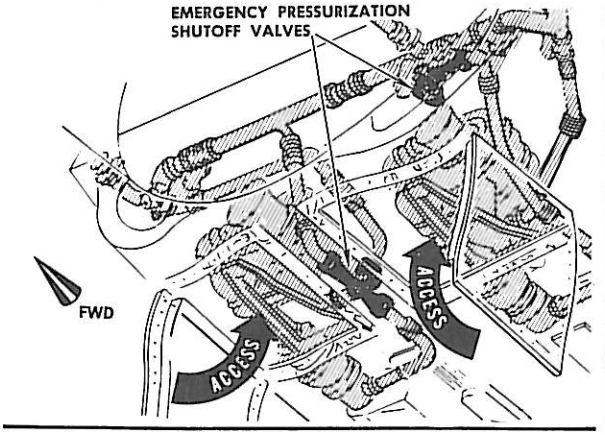
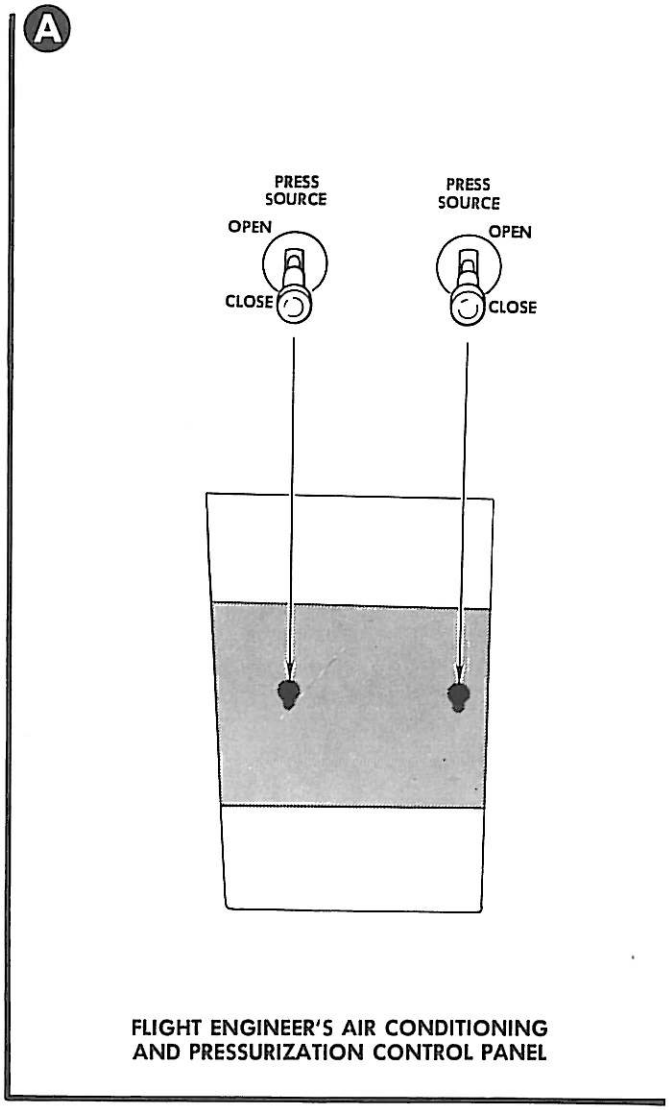
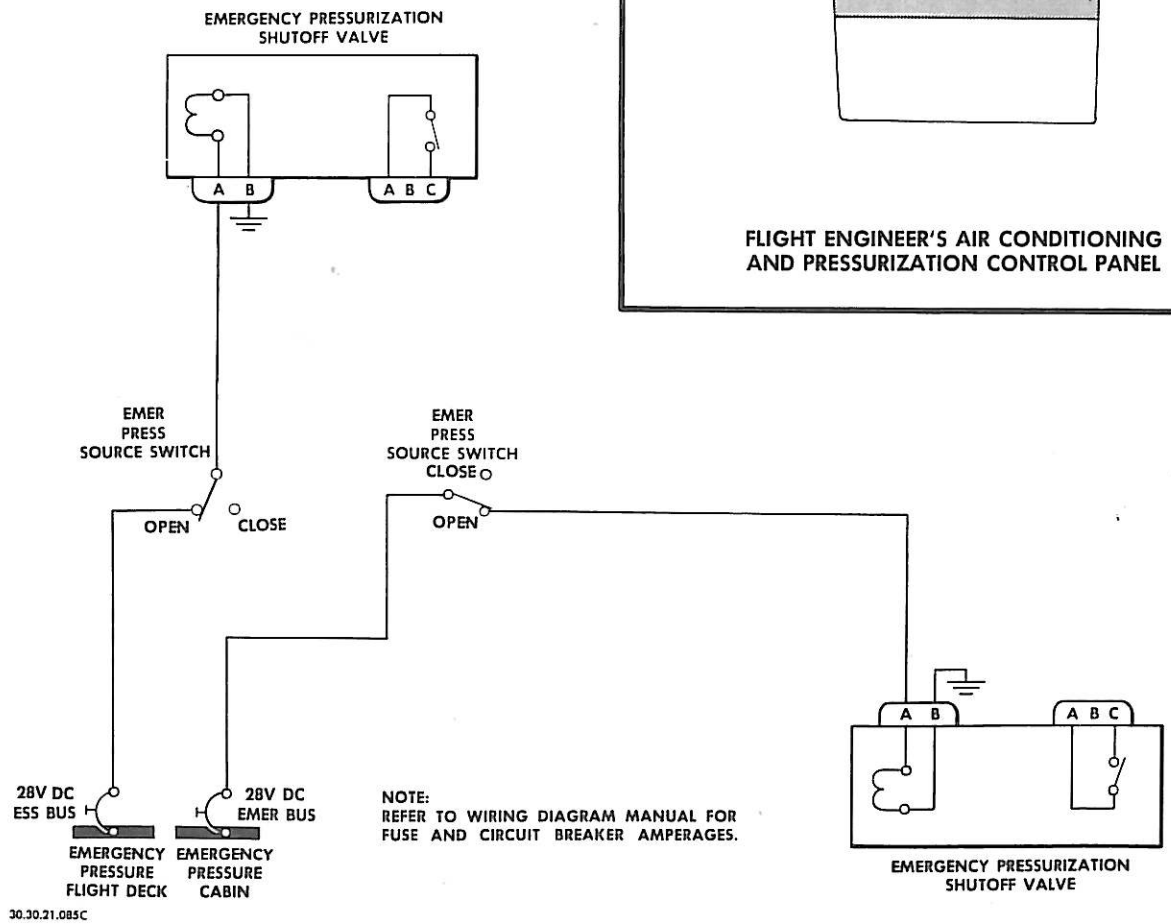
Emergency Pressurization Flow Pattern
Figure 1







FLIGHT ENGINEER'S AIR CONDITIONING AND PRESSURIZATION CONTROL PANEL



Emergency Pressurization Control Schematic
Figure 2

EMERGENCY PRESSURIZATION - TROUBLE SHOOTING

POSSIBLE CAUSE	ISOLATION PROCEDURE AND CORRECTION
CAUTION: THE EMERGENCY PRESSURIZATION SYSTEM SHALL NOT BE OPERATED FOR MORE THAN 15 SECONDS WHILE THE AIRPLANE IS ON THE GROUND. THE ABSENCE OF RAM AIR FOR COOLING THE AIR-TO-AIR HEAT EXCHANGER CAN LEAD TO EXCESSIVELY HIGH TEMPERATURES AT THE FREON EVAPORATOR.	
1. NO AIR FLOW INDICATED (BLEED AIR PRESSURE OK)	
A. Faulty air flow indicating system.	Operating only the suspected emergency pressurization valve, feel for air flow at any cabin outlet. If air is flowing, check airflow indicator, or flow sensor and transmitter. (Refer to 21-4-10, Maintenance Practices).
B. Electrical malfunction.	Disconnect electrical connector from emergency pressurization shutoff valve. Place PRESS SOURCE switch in OPEN position. Check for 28-volts dc between pins A and B of the removed connector. If 28-volts dc not present, check continuity through PRESS SOURCE switch to the PRESSURE SOURCE circuit breaker. If 28-volts dc is present, see paragraph 2.
2. AIRFLOW TOO HIGH, TOO LOW, OR FLUCTUATING	
A. Filter element clogged.	Remove, clean, and reinstall filter on emergency pressurization shutoff valve.
B. Tubing connections leaking.	Check and tighten tubing connections on emergency pressurization shutoff valve. If above procedures do not eliminate trouble, replace emergency pressurization shutoff valve.

EMERGENCY PRESSURIZATION SHUTOFF VALVE - DESCRIPTION AND OPERATION

1. Description

The emergency pressurization shutoff valve, shown on Figure 1, consists of a flow-measuring venturi, a spoon valve, a pneumatic actuator (mechanically linked to the spoon valve), a pressure regulator, a servo relief metering valve, an air filter, a shutoff solenoid valve, and a valve position indicator switch.

Two pressure sensing ports, located at the inlet and throat of the venturi, are connected by tubing to the servo relief metering valve. The servo relief metering valve consists of an inlet pressure chamber, connected by tubing to the venturi inlet port, and a throat pressure chamber, connected by tubing to the venturi throat port. The chambers are separated by a spring-loaded diaphragm which opposes a spring-loaded pressure-relief metering valve. The metering valve is connected by tubing to the pneumatic actuator pressure chamber.

The pneumatic actuator contains a diaphragm which separates an ambient pressure chamber from an actuator pressure chamber. The ambient chamber side of the diaphragm is mechanically linked to the spoon valve and is spring-loaded to close the valve. The control air pressure for the actuator pressure chamber is taken from a port at the venturi outlet and is routed through the solenoid valve and pressure regulator valve. The actuator pressure chamber is also connected by tubing to the servo relief metering valve.

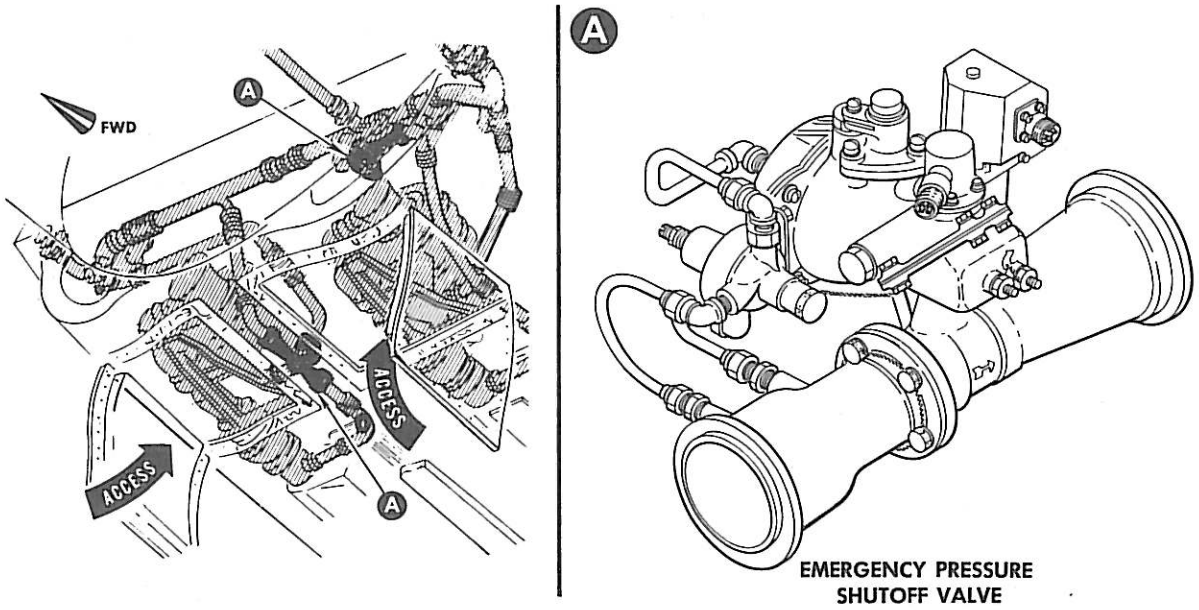
The solenoid valve is a single-port poppet-type valve actuated by a control solenoid. The solenoid is contained within the pneumatic actuator body and is positioned to open and close drilled passages in the actuator body.

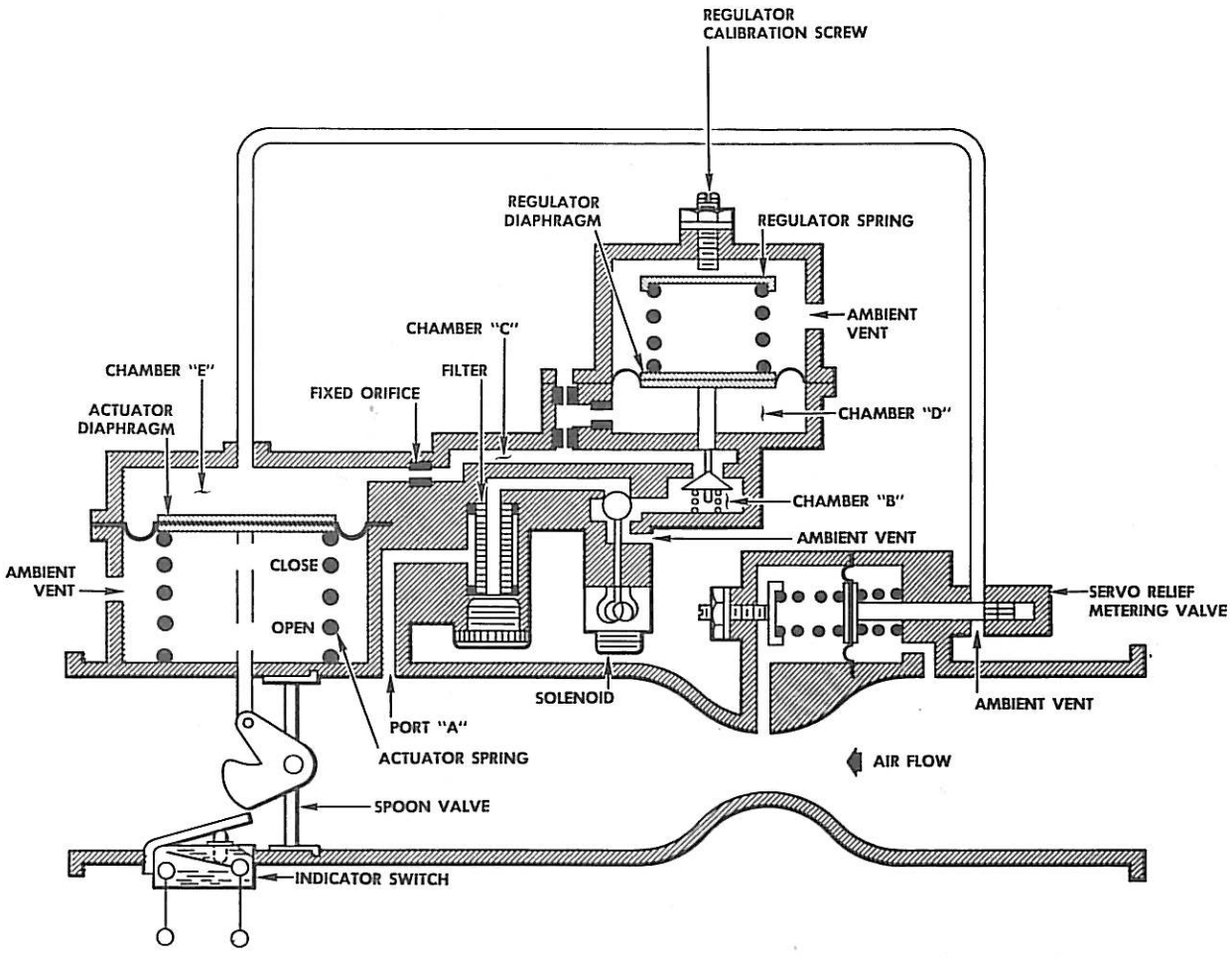
The pressure regulator assembly contains a valve which is operated by a diaphragm separating an ambient pressure chamber from a differential pressure chamber. The valve is positioned to open or close a passage between the solenoid valve and the pneumatic actuator pressure chamber.

The position indicator switch is actuated by a shaft which extends through the switch support and engages with the spoon valve shaft. The switch is open when the spoon valve is closed; the switch is closed to complete the circuit when the spoon valve is open five degrees or more from the full-closed position. A notch in the end of the position indicator shaft points to the words OPEN and CLOSED, stamped on the switch cover, to indicate the position of the spoon valve.

2. Operation

When the control solenoid is de-energized, the emergency pressurization shutoff valve is inoperative and the spoon valve is held closed by the spring-loaded diaphragm in the actuator. When the solenoid is energized, the solenoid valve opens a passage from port A on the upstream side of the valve body to the pressure regulator and the pneumatic actuator. The minimum valve opening pressure is 9 psig.


A
FWD
A
ACCESS
ACCESS
A
EMERGENCY PRESSURE
SHUTOFF VALVE


REGULATOR
CALIBRATION SCREW
REGULATOR
DIAPHRAGM
REGULATOR SPRING
AMBIENT
VENT
CHAMBER "C"
FILTER
CHAMBER "E"
FIXED ORIFICE
ACTUATOR
DIAPHRAGM
CHAMBER "D"
CHAMBER "B"
AMBIENT VENT
AMBIENT
VENT
CLOSE
OPEN
SERVO RELIEF
METERING VALVE
SOLENOID
AMBIENT VENT
PORT "A"
ACTUATOR SPRING
AIR FLOW
SPOON VALVE
INDICATOR SWITCH

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The pressure regulator maintains a constant differential pressure between chambers C and D and ambient. The subsequent movement of the regulator diaphragm and regulator valve modulates the pressure entering the regulator. The pressure from chamber C is supplied through an orifice to the actuator diaphragm chamber E to oppose the force of the spring-loaded diaphragm.

When the venturi inlet-to-throat differential pressure becomes greater than the calibrated value, the diaphragm in the servo metering valve opens the valve to bleed air pressure from chamber E of the pneumatic actuator, causing the spoon valve to move toward the closed position. The servo relief metering valve regulates actuator pressure in chamber E to rise and fall with varying airflow through the venturi. The resultant movement of the actuator diaphragm and spoon valve controls the airflow through the valve body.

When the control solenoid is de-energized, the solenoid valve closes the passage from port A to the pressure regulator and the pneumatic actuator, and allows the residual pressure in the regulator and actuator to vent to ambient. With the pressure vented, the spring-loaded diaphragm in the actuator closes the spoon valve. The indicator switch and circuit are open when the spoon valve is open less than five degrees.

EMERGENCY PRESSURIZATION SHUTOFF VALVE - MAINTENANCE PRACTICES

1. Removal/Installation Emergency Pressurization Shutoff Valve (see Figure 201)

   A. Equipment Required - None.

   B. Preparation.

      (1) Open PRESSURE SOURCE circuit breaker (cabin or flight compartment as required).

      (2) Open turbocompressor access door (cabin or flight compartment as required).

         NOTE: The cabin emergency pressurization shutoff valve is accessible upon opening the access door. The flight compartment emergency pressurization shutoff valve is accessible only after removal of the turbocompressor package (refer to 21-1-1, Maintenance Practices).

      (3) Place warning tags on flight deck and place signs near ground air connections to prevent other personnel from starting the engines, or connecting a ground pneumatic supply.

         CAUTION: REMOVAL OF AN EMERGENCY PRESSURIZATION SHUTOFF VALVE WILL LEAVE AN OPENING IN THE MAIN BLEED AIR MANIFOLD. DO NOT OPERATE ENGINES OR PRESSURIZE THE MANIFOLD WITH A GROUND CART WHILE THE VALVE IS REMOVED.

   C. Remove Cabin Emergency Pressurization Shutoff Valve.

      (1) Disconnect electrical connector from valve actuator. (Cap connector and receptacle. Tag for installation.)

      (2) Remove safety pins from duct clamps; remove nuts securing duct clamps and remove clamps.

      (3) Remove gaskets between ducts and valve body. (Bag and tag hardware for installation.)

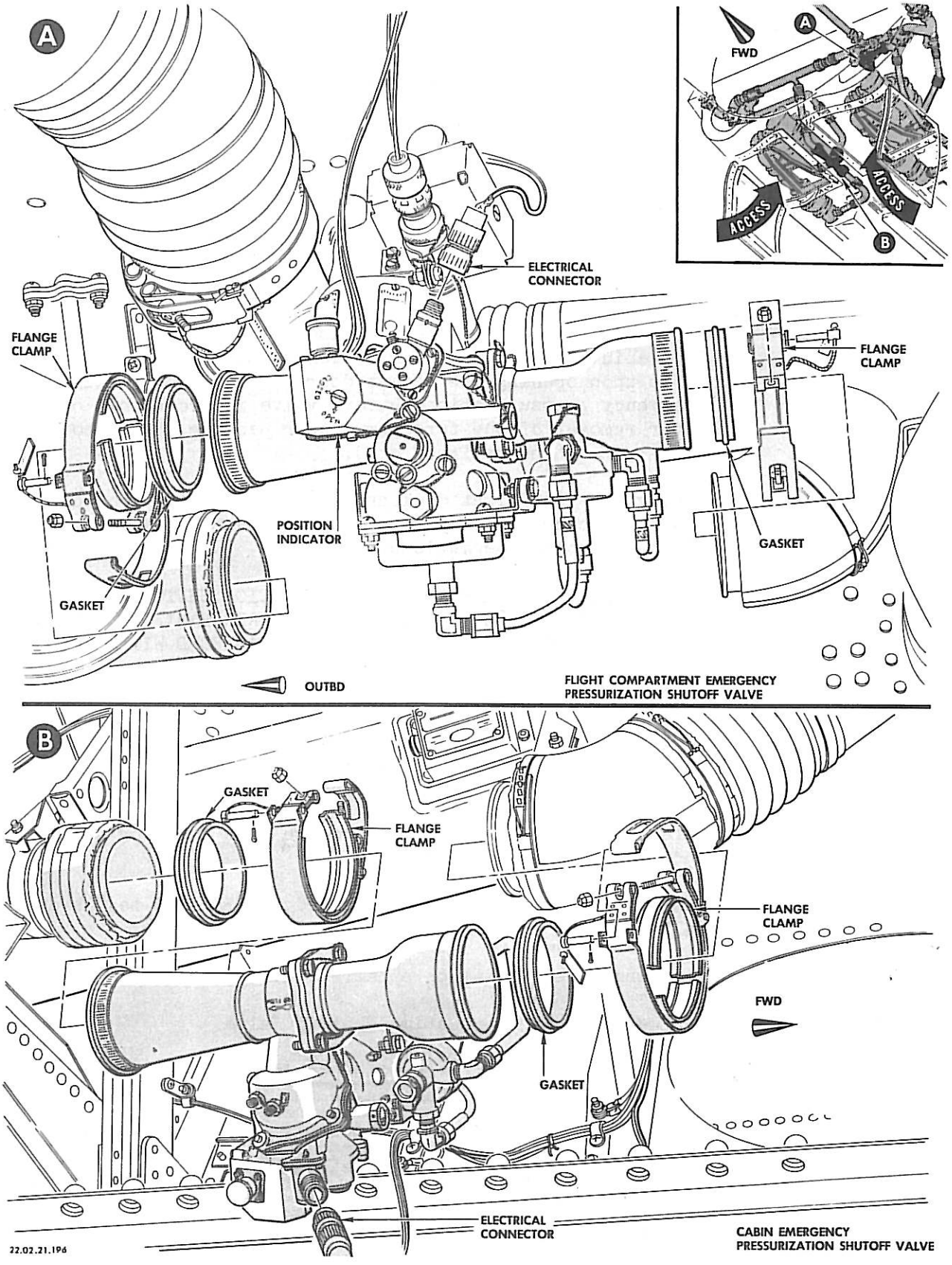
      (4) Remove emergency pressurization shutoff valve.

   D. Install Cabin Emergency Pressurization Shutoff Valve.

      (1) Position valve between duct ends with the direction of flow arrow pointing aft. The actuator shall be on the inboard side with the electrical receptacle pointing down.

      (2) Insert gaskets between ducts and valve body.

      (3) Install and secure duct clamp on each end of valve (refer to Chapter 36, PNEUMATIC).



Emergency Pressurization Shutoff Valve
Installation
Figure 201

(4) Connect electrical connector to valve receptacle.

(5) Close CABIN PRESSURE SOURCE circuit breaker.

(6) Perform Adjustment/Test of emergency pressurization shutoff valve.

(7) Close turbocompressor access door.

(8) Remove warning tag from cockpit.

E. Remove Flight Compartment Emergency Pressurization Shutoff Valve.

(1) Disconnect electrical connector from valve actuator. (Located above and forward of the turbocompressor.) (Cap connector and receptacle. Tag harness for installation.)

(2) Remove safety pins from duct clamps; remove nuts securing duct clamps and remove clamps.

(3) Remove gaskets between ducts and valve body.

(4) Remove emergency pressurization shutoff valve.

F. Install Flight Compartment Emergency Pressurization Shutoff Valve.

(1) Position emergency pressurization shutoff valve between duct ends with the direction of flow arrow pointing outboard. Electrical receptacle shall be above actuator housing.

(2) Install gaskets between ducts and valve body.

(3) Install and secure duct clamp on each end of valve (refer to Chapter 36, PNEUMATIC).

(4) Connect electrical connector to valve receptacle.

(5) Close FLT DECK PRESSURE SOURCE circuit breaker.

(6) Perform Adjustment/Test of emergency pressurization shutoff valve.

(7) Close turbocompressor access door.

(8) Remove warning tag from cockpit.

2. Adjustment/Test

A. Equipment Required and Preparation. A pneumatic and electrical power source. This can be obtained from ground carts or by operating one of the engines (refer to 21-0, Maintenance Practices).

B. Test Emergency Pressurization Shutoff Valve (cabin or flight compartment).

(1) With pneumatic and electrical power available, place the PRESS SOURCE switch in OPEN position for not more than 15 seconds. An airflow of approximately 40 pounds per minute should be indicated on COMPRESSOR AIR FLOW indicator on flight engineer's panel.

CAUTION: THE EMERGENCY-PRESSURIZATION SHUTOFF VALVE SHALL NOT BE OPENED FOR MORE THAN 15 SECONDS WHILE THE AIRPLANE IS ON THE GROUND. THE ABSENCE OF RAM AIR FOR COOLING THE HEAT EXCHANGER CAN LEAD TO EXCESSIVELY HIGH TEMPERATURES AT THE FREON EVAPORATOR.

(2) After completion of test, shut down engine or disconnect ground carts as required.

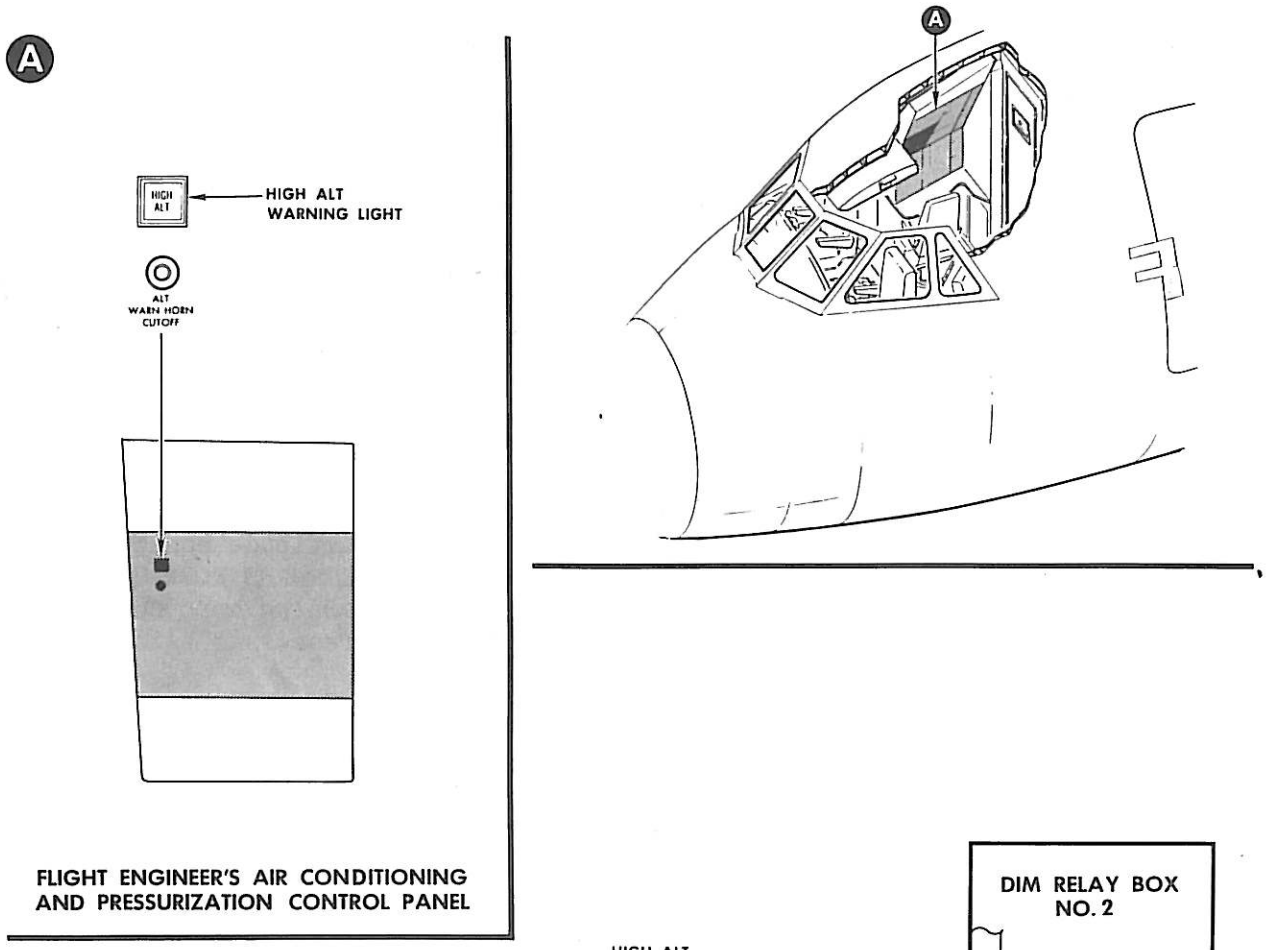
CABIN HIGH ALTITUDE WARNING SYSTEM - DESCRIPTION AND OPERATION

1. Description

The cabin high altitude warning system, shown on Figure 1, consists of a pressure sensing switch, a red warning light and a warning horn. The pressure switch is located behind the panel above the radio portion of the main circuit breaker panel. The red HIGH ALT warning light is on the flight engineer's air conditioning and pressurization control panel.

2. Operation

The cabin HIGH ALT warning light illuminates automatically through actuation of the pressure sensing switch. The switch actuates when cabin altitude exceeds 10,000 feet and will not deactuate until the cabin altitude is lowered to less than 10,000 feet. The warning horn sounds intermittently, 3 seconds on and 1 second off, to identify the high altitude condition. The horn can be stopped by momentarily pushing the ALT WARN HORN CUT OFF button just below the HIGH ALT warning light. The warning horn cutout relay is automatically reset when cabin altitude decreases to below 10,000 feet.


A
HIGH ALT
HIGH ALT WARNING LIGHT
ALT WARN HORN CUTOFF
FLIGHT ENGINEER'S AIR CONDITIONING AND PRESSURIZATION CONTROL PANEL
A
DIM RELAY BOX NO. 2
HIGH ALT WARNING LIGHT
CABIN ALT WARNING LIGHT
28V DC ESS BUS
R
U
U
TEST
NOTE:
REFER TO WIRING DIAGRAM MANUAL FOR FUSE AND CIRCUIT BREAKER AMPERAGES.
HIGH ALT WARNING CUT-OFF SWITCH
PRESSURE SENSOR
NORMAL
AIR PRESSURE AT 10,000' FT CAB ALT
B
C
A
X1
X2
A1
A2
A3
HIGH ALTITUDE WARNING HORN RELAY
DIODE
C
D
WARNING HORN TIMER
WARNING HORN TIMER DIODE
WARNING HORN
2

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CABIN HIGH ALTITUDE WARNING SYSTEM - TROUBLE SHOOTING

POSSIBLE CAUSE	ISOLATION PROCEDURE AND CORRECTION
1. NO WARNING LIGHT OR WARNING HORN WHEN CABIN ALTITUDE EXCEEDS 10,000 FEET	
A. Faulty pressure switch.	Remove connector from pressure switch located behind panel above the radio portion of main circuit breaker panel. Simulate high altitude by connecting terminals B and C of removed connector. If warning system operates, replace pressure switch.
B. Faulty wiring.	Remove pressure switch connector as outlined above. Check for 28-volts dc on terminal B or removed connector. If 28 volts present, check wiring to high altitude warning horn relay and to dimming relay. If 28 volts is not present, check wiring from terminal B to CABIN ALT WARN circuit breaker.
2. WARNING HORN SOUNDS BUT WARNING LIGHT INOPERATIVE	
A. Faulty light bulb.	Push PRESS-TO-TEST switch. If bulb does not illuminate, replace bulb. (Refer to Chapter 31, INSTRUMENTS.)
B. Faulty wiring or dimming relay.	Check circuit from pressure switch through dimming relay to warning light.
3. WARNING LIGHT ILLUMINATES BUT WARNING HORN INOPERATIVE	
A. Faulty component in warning horn circuit.	Check operation of warning horn and warning horn timer. (Refer to Chapter 31, INSTRUMENTS.)
B. Faulty wiring or high altitude warning horn relay.	Check circuit from pressure switch through high altitude warning horn relay to warning horn timer.
4. WARNING HORN WILL NOT CUT OUT WHEN CUTOUT SWITCH IS ACTUATED	
A. Faulty cutout switch.	
B. Faulty wiring or high altitude warning horn relay.	Check operation of switch. Remove high altitude warning horn

POSSIBLE CAUSE	ISOLATION PROCEDURE AND CORRECTION
	relay from socket. With cutout switch depressed, check for 28-volts dc at socket terminal X1. If 28-volts not present, check circuit from X1, through cutout switch to CABIN ALT WARN circuit breaker. If 28-volts dc is present at socket terminal X1, check for continuity between socket terminal X2 and ground. If no continuity, check wiring from socket terminal X2 to ground. If continuity is present, change relay.

5. WARNING HORN CUTS OUT ONLY WHILE CUTOUT SWITCH IS DEPRESSED

A. Faulty relay or wiring.	Remove high altitude warning horn relay from socket. Check for continuity between socket terminals A1 and X1. If no continuity, check wiring between A1 and X1. If continuity is present, change relay.

TEMPERATURE INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. Description

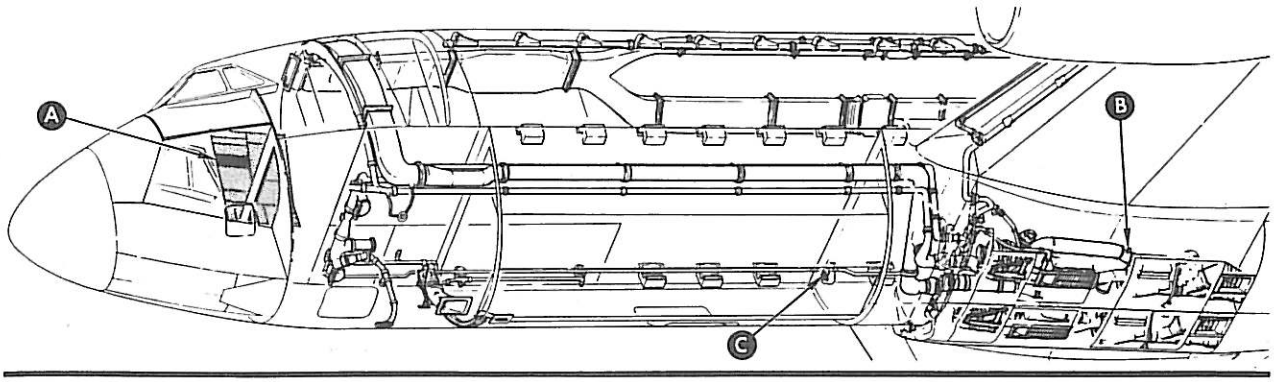
The temperature indicating system, shown on Figure 1, consists of three resistance-type temperature sensing probes, a rotary selector switch and an indicator. The selector switch and indicator are located on the flight engineer's control panel. One temperature probe is located in a cabin air discharge duct, and one each is installed in the cabin and flight deck Freon evaporator air discharge ducts.

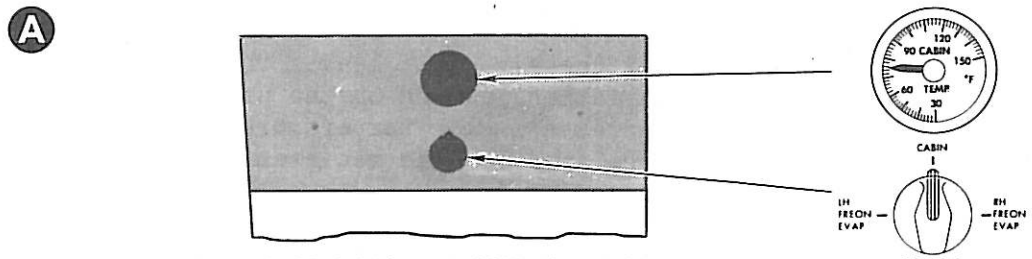
2. Operation

The probes sense the temperature of the air as it leaves the cabin and the Freon evaporators. Temperature variations acting on the probes vary their resistance, thus an increase or decrease in air temperature causes a corresponding increase or decrease in resistance. The resistance of the probe determines the current flow to the indicator.

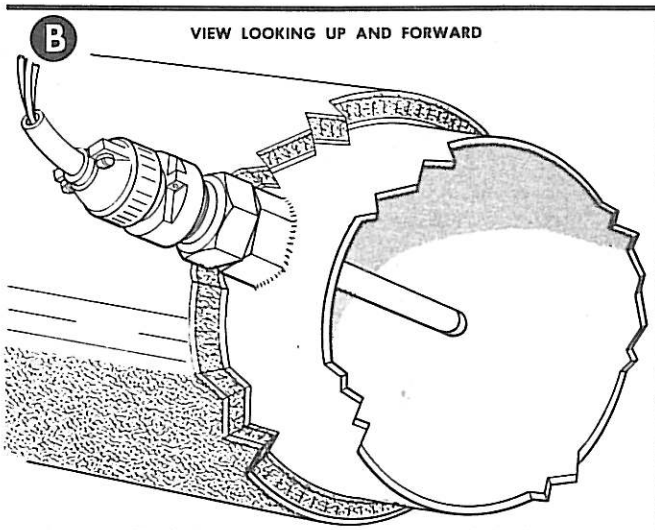
The indicator is essentially a ratiometer which operates on the electric bridge principle. In this application, each sensing probe acts individually as one leg of the bridge circuit, depending on the position of the CABIN TEMP SELECTOR switch.

The sensing probes in the evaporator ducts enable the flight engineer to individually monitor the operation of each air conditioning package. In the event a malfunction of an air conditioning package is suspected, the flight engineer can readily determine the faulty package by use of the selector switch. Placing the switch in either the LH or RH FREON EVAP position provides an indication of the Freon evaporator discharge air temperature for each package. An abnormal temperature, either high or low, depending on the mode of operation of the system, at either or both of the evaporator outlets is evidence of a malfunctioning package or system.

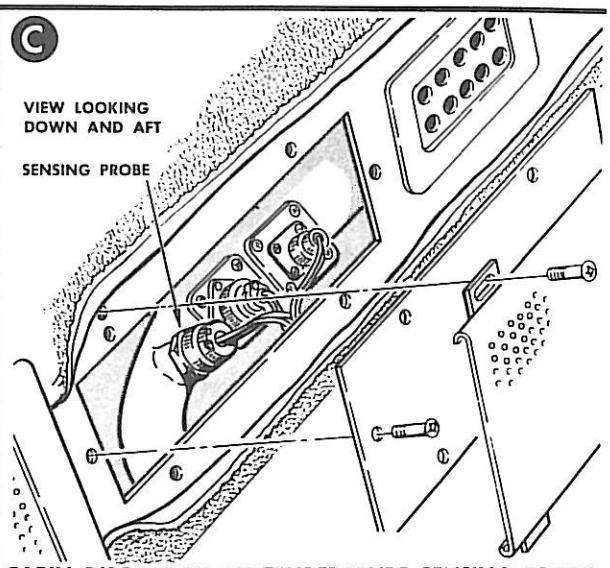




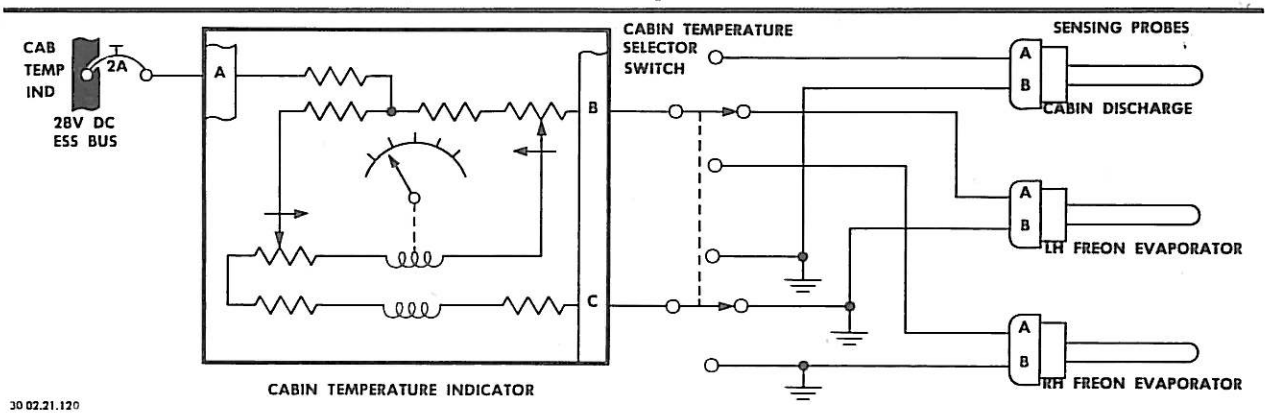
AIR CONDITIONING CONTROL PANEL



FREON EVAPORATOR DISCHARGE AIR TEMPERATURE SENSING PROBE
(LH SHOWN-RH SIMILAR)



CABIN DISCHARGE AIR TEMPERATURE SENSING PROBE



CABIN TEMPERATURE INDICATOR

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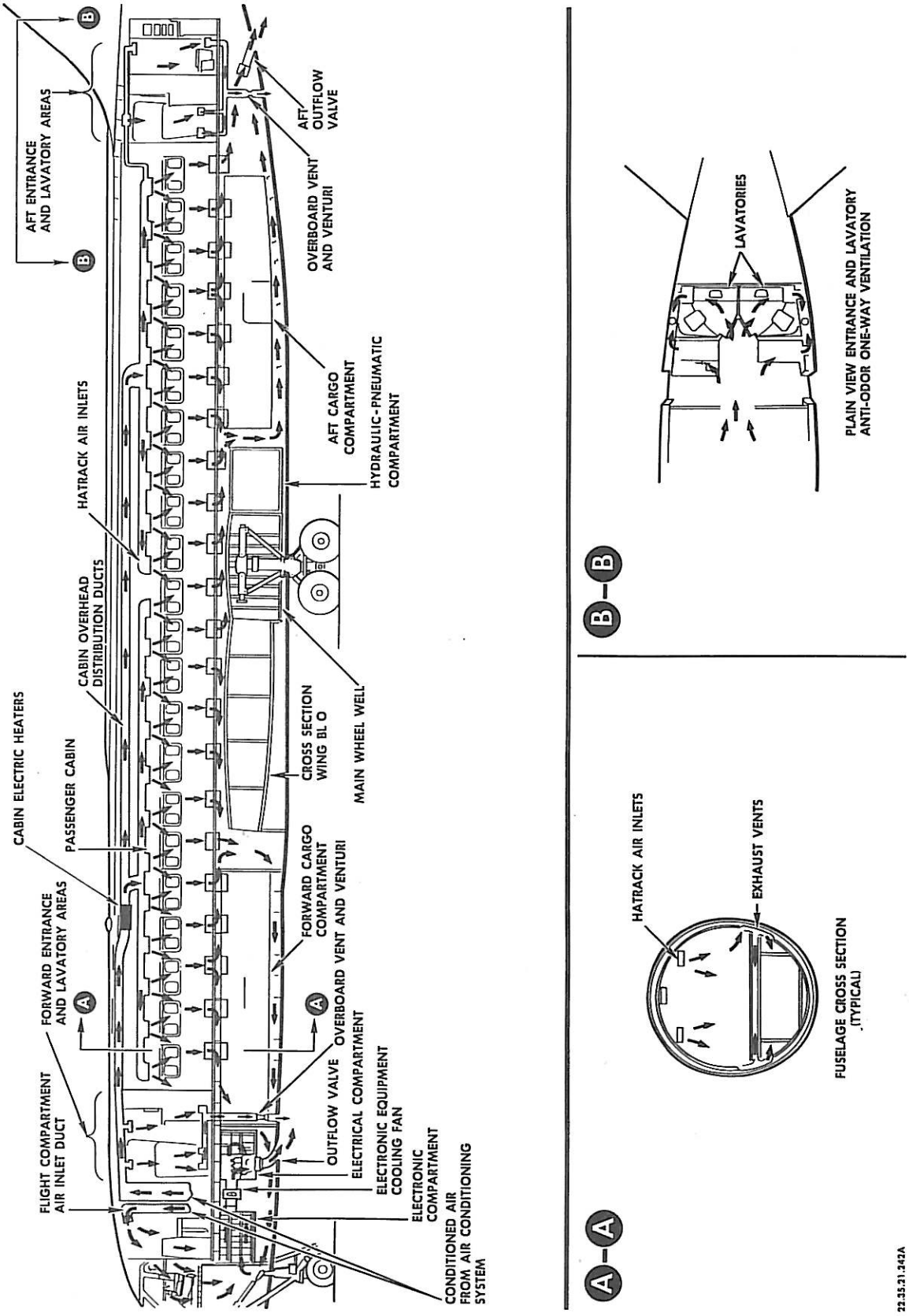
AIR DISTRIBUTION SYSTEM - DESCRIPTION AND OPERATION

1. General

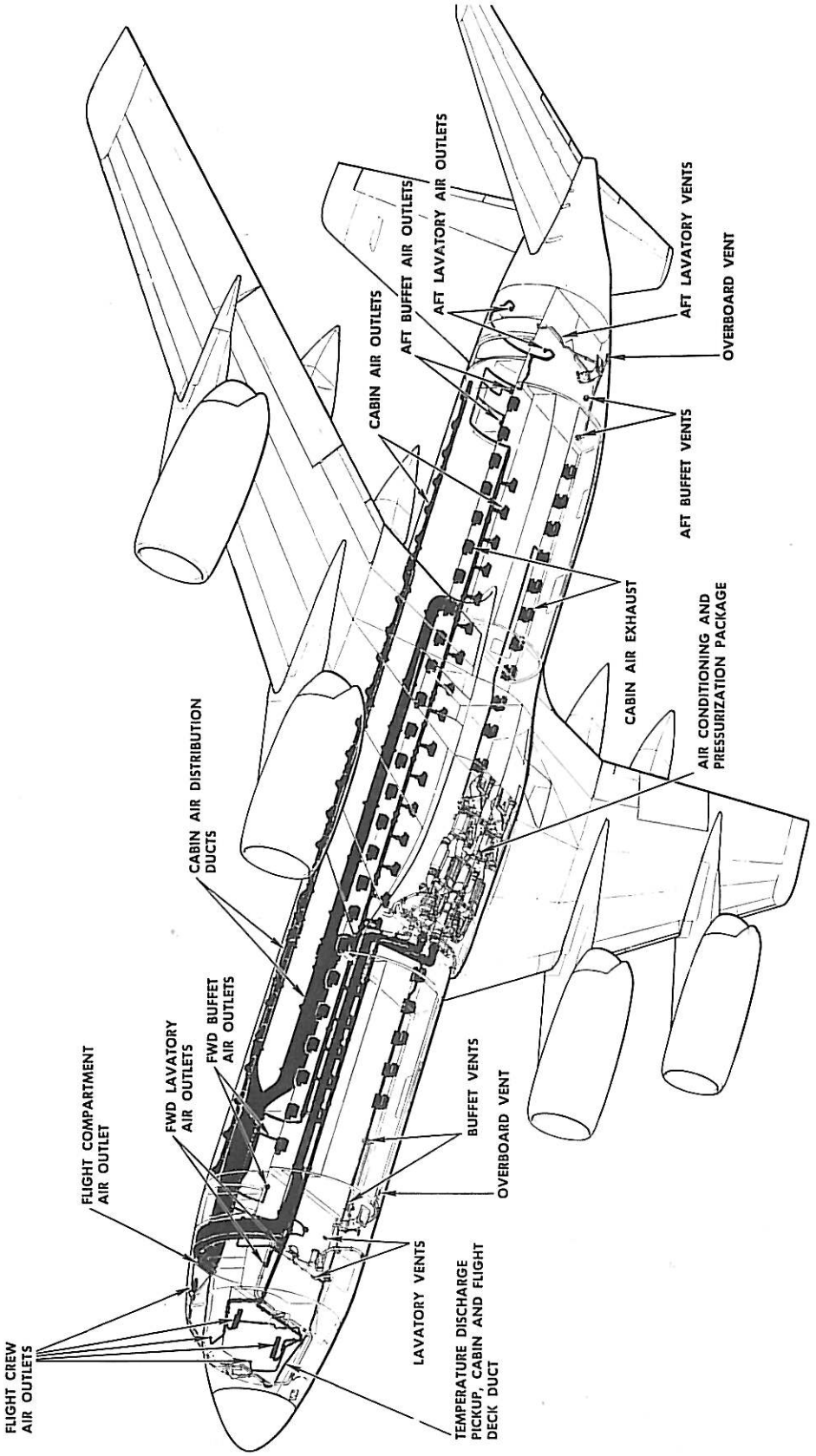
The air distribution system delivers conditioned air from the air conditioning packages to the flight and passenger compartments. A schematic of the air flow is shown on Figure 1. The air distribution system is illustrated on Figure 2. Aluminum and fiberglas ducting is used to deliver the conditioned air to vents mounted along the sides of the cabin just below the hatracks. The vent openings are covered by a perforated escutcheon plate along each side of the cabin. The location and design of the vents permits an even distribution of conditioned air throughout the passenger compartment with no drafts at any passenger location. The ducts and vents minimize sound generation by the conditioned air as it moves through the ducts and out of the vents. Additional adjustable air inlets (ventilators) are installed above each passenger's seat, next to the reading light, on the lower surface of the hatracks. Conditioned air for the flight compartment is delivered by aluminum and fiberglas ducting and discharged above the flight crew's heads and at their leg level. Additional adjustable ventilators are installed above and forward of each crew seat.

Air is exhausted from the cabin through vents along the cabin sides just above the floor. The vent openings are covered by a perforated escutcheon plate along each side of the cabin. These vents conduct the exhaust air into the area below the floor. The flight compartment air is also exhausted below the floor. The air below the forward floor flows through the electronics compartment to cool and ventilate the electronics equipment and then through the electrical compartment and overboard through the forward cabin pressure regulator and out-flow valve, or the electronic equipment cooling valve. The air below the aft floor flows rearward, around and below the baggage compartments to stabilize temperatures in the baggage compartments, and then further aft to the aft pressure regulator and outflow valve where it is vented overboard.

To prevent odors from entering the passenger areas, all lavatories and buffets are ventilated by a one-way ventilation system. The conditioned air directed to these areas is vented directly overboard through tubing, a venturi to limit flow, and overboard vents.



Airflow and Pressurization Schematic
Figure 1

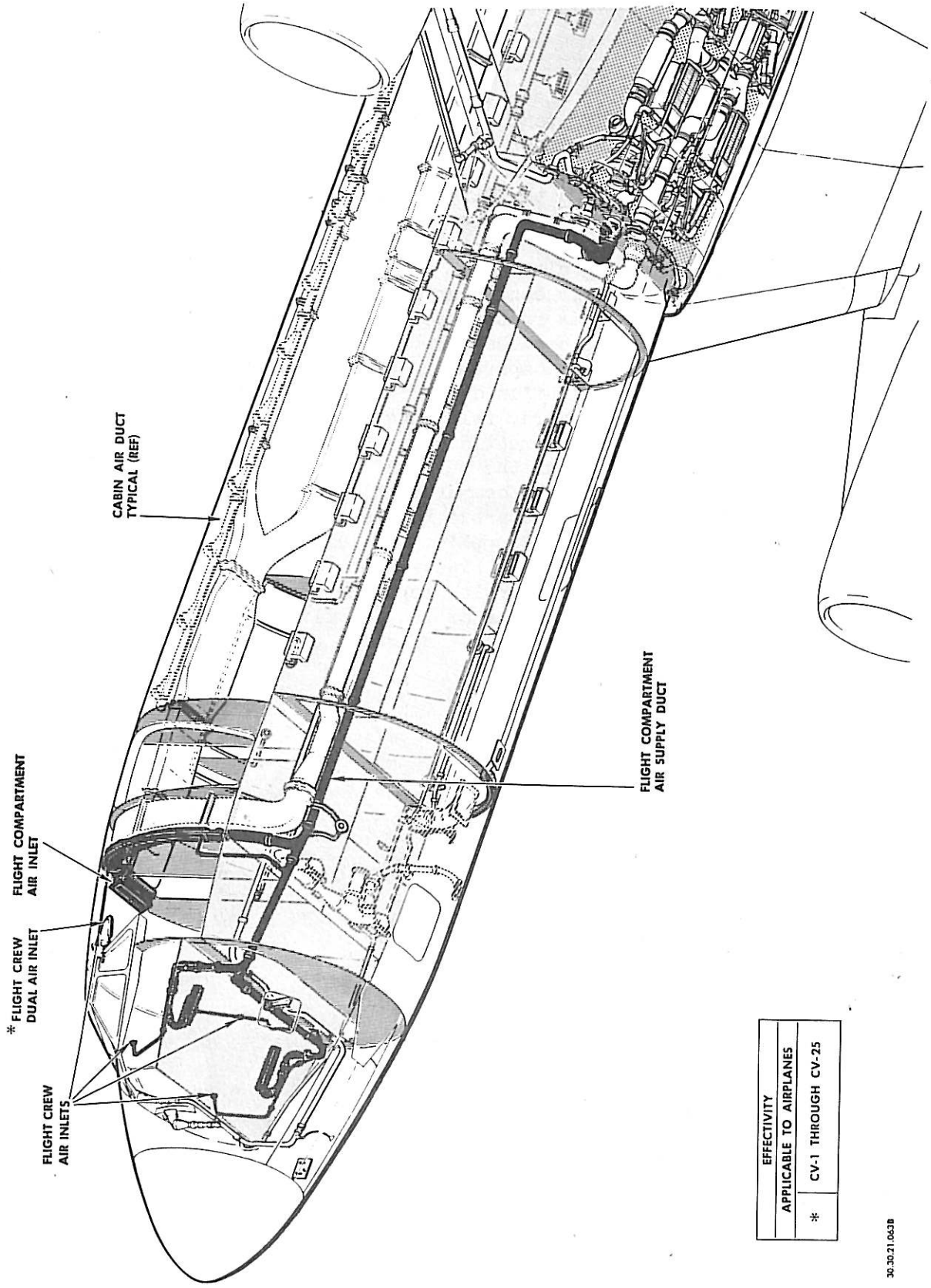

AFT LAVATORY AIR OUTLETS
AFT BUFFET AIR OUTLETS
CABIN AIR OUTLETS
AFT LAVATORY VENTS
OVERBOARD VENT
AFT BUFFET VENTS
CABIN AIR EXHAUST
AIR CONDITIONING AND PRESSURIZATION PACKAGE
CABIN AIR DISTRIBUTION DUCTS
FWD BUFFET AIR OUTLETS
FWD LAVATORY AIR OUTLETS
FLIGHT COMPARTMENT AIR OUTLET
BUFFET VENTS
OVERBOARD VENT
LAVATORY VENTS
TEMPERATURE DISCHARGE PICKUP, CABIN AND FLIGHT DECK DUCT
FLIGHT CREW AIR OUTLETS
30.30.21.062A

FLIGHT COMPARTMENT AIR DISTRIBUTION DUCTS - DESCRIPTION AND OPERATION

1. Description

The flight compartment air conditioning package normally delivers conditioned, pressurized air to the flight compartment air distribution system. See Figure 1. If the flight compartment air conditioning system is shut down, an interconnection with the cabin air conditioning system will permit an adequate flow through the flight compartment ducts. A flow limiter downstream of the cabin conditioned air check valve allows approximately 10 percent of the conditioned air flow into the flight deck distribution system. The remaining airflow is ducted to the cabin system. From the forward bulkhead of the air conditioning compartment, the flight compartment air distribution duct is routed to the lower left side of the airplane. It then runs forward along the left side, outboard of the forward cargo compartment, to the flight compartment. At a point just aft of the flight compartment, the distribution duct divides into two ducts. The larger of the two ducts curves upward, following the skin contour, to a point directly over the flight compartment door. It connects with a large discharge duct which extends through the bulkhead and directs the flow of air down and forward into the flight compartment. The smaller duct runs forward from the junction mentioned above to the area under the flight compartment floor. From this point it supplies the left and right side air inlets and the adjustable air inlets (ventilators) on the auxiliary instrument panels. Controls on the consoles regulate the flow through the side air inlets. An adjustable ventilator for the flight engineer's station, *and a dual ventilator for the second officer's station, are supplied from this duct.

*Applicable to airplanes CV-1 through CV-25.



Flight Deck Air Distribution Ducts
Figure 1

FLIGHT COMPARTMENT AIR DISTRIBUTION DUCTS - MAINTENANCE PRACTICES

1. Removal/Installation Flight Compartment Adjustable Air Inlets (Ventilators) (see Figure 201)

   A. Equipment Required - None.

   B. Remove Pilot's and Co-Pilot's Ventilators.

      (1) Unscrew threaded trim cover from face of ventilator.

      (2) Release two hose clamps from coupling which secures ventilator to tubing on back side of instrument panel.

      (3) Remove four screws securing ventilator to instrument panel and remove ventilator. (Cover open tubing to prevent entrance of foreign matter.)

   C. Install Pilot's and Co-Pilot's Ventilators.

      NOTE: Prior to installing ventilator ascertain that spiral groove inside valve body is free of chips or foreign matter which may cause the ventilator to bind and/or not seal properly in the closed position.

      (1) Insert duct end of ventilator through instrument panel. Connect ventilator duct to tubing with coupling and secure with two hose clamps.

      (2) Align holes in ventilator mounting flange with holes in instrument panel and secure ventilator with four screws.

      (3) Screw threaded trim cover onto face of ventilator; tighten trim cover.

      (4) Perform Adjustment/Test of pilots' ventilators.

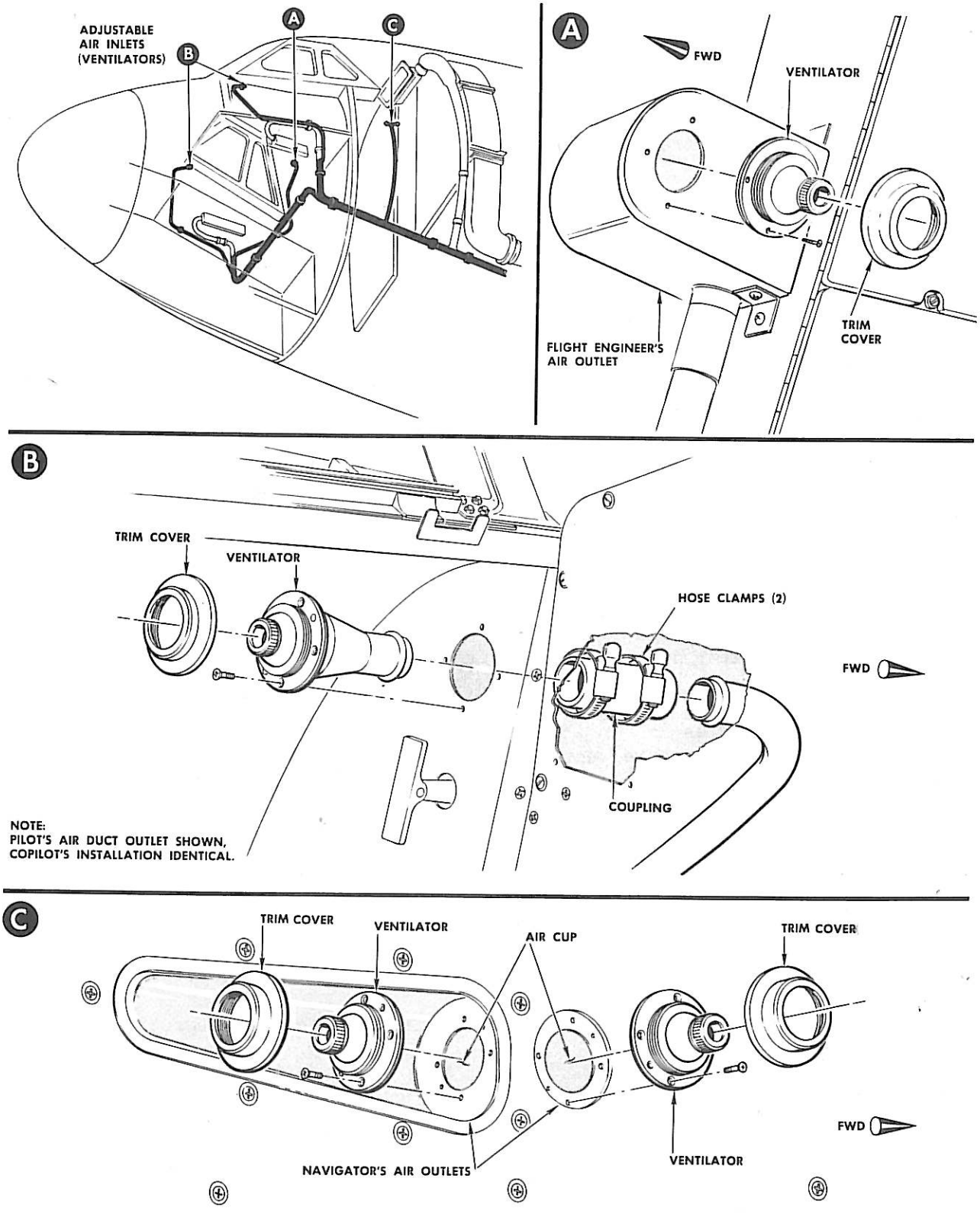
   D. Remove Flight Engineer's Ventilator.

      (1) Unscrew threaded trim cover from face of ventilator.

      (2) Remove four screws securing ventilator to air cup structure and remove ventilator.

   E. Install Flight Engineer's Ventilator.

      NOTE: Prior to installing ventilator ascertain that spiral groove inside valve body is free of chips or foreign matter which may cause the ventilator to bind and/or not seal properly in the closed position.



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Flight Deck Ventilator Installation (Detail C applicable to airplanes CV-1 through CV-25)
Figure 201

(1) Place inlet end of ventilator into air cup. Align holes in ventilator mounting flage with nutplates in air cup structure and secure ventilator with four screws.

(2) Screw threaded trim cover onto face of ventilator; tighten trim cover.

(3) Perform Adjustment/Test of flight engineer's ventilator.

2. Adjustment/Test Flight Compartment Adjustable Air Inlets (Ventilators)

For Adjustment/Test of the flight compartment ventilators, refer to 21-9-2, Maintenance Practices.

PASSENGER COMPARTMENT AIR DISTRIBUTION DUCTS - DESCRIPTION AND OPERATION

1. Description

The primary source of conditioned, pressurized air for the passenger compartment air distribution system is the cabin air conditioning package. See Figure 1. Under normal conditions, most of the output of the flight compartment air conditioning package is also delivered to the passenger compartment. If it should become necessary to shut down the cabin air conditioning system, the flight compartment system will supply an adequate flow for reasonable passenger comfort. From the forward bulkhead of the air conditioning compartment, the passenger compartment supply duct is routed to the lower left side of the airplane. It then runs forward along the left side, outboard of the forward cargo compartment, to a point slightly forward of the forward entrance door. At this point, the round duct connects with a vertical rectangular duct that routes the air to the top centerline of the fuselage. The vertical section follows the skin contour, passing through the forward coat closet, to an overhead duct arrangement installed between the fuselage structure and the interior trim.

From the forward entrance area a single large rectangular duct runs aft along the overhead centerline. At a point in line with the seventh passenger window from the front, the single duct divides into a left and right overhead duct. Each of these ducts supplies its respective forward and aft outlet manifolds. The left and right overhead ducts run parallel to the centerline and are offset approximately two and one-half feet. Electric heaters are installed in the overhead ducts just before the ducts branch to the fore and aft manifolds. At a point in line with the seventeenth passenger window from the front, a branch connects with the forward outlet manifold. The left and right overhead ducts continue aft and connect to the aft outlet manifolds. This junction is at a point in line with the thirteenth passenger window from the aft end.

Conditioned air enters each outlet manifold at the midpoint. It then travels forward and aft to supply the side air inlets, the adjustable air inlets (ventilators), and the entrance and lavatory areas. The side air inlets are distributed along the entire length of the passenger compartment, and an adjustable ventilator is located above each passenger seat. By supplying the air through a large number of outlets, it is possible to circulate a relatively large volume of air without producing uncomfortable drafts at any location.

Cabin air is exhausted through vents located near the floor along the entire length of the cabin. These vents exhaust the air to the area under the passenger compartment floor where it may go either forward or aft to the cabin pressure regulating outflow valves. The air routed forward is used to cool the electronic and electrical equipment compartments.

PASSENGER COMPARTMENT AIR DISTRIBUTION DUCTS - MAINTENANCE PRACTICES

1. Removal/Installation Passenger Convenience Pod Adjustable Air Inlet (Ventilator)

   A. Equipment Required - None.

   B. Remove Passenger Convenience Pod Ventilator.

      (1) Remove escutcheon trim from passenger convenience pod (refer to Chapter 25, FURNISHINGS).

      (2) Remove four screws securing ventilator mounting flange to convenience pod; remove ventilator.

   C. Install Passenger Convenience Pod Ventilator.

      NOTE: Prior to installing ventilator ascertain that spiral groove inside valve body is free of chips or foreign matter which may cause the ventilator to bind and/or not seal properly in the closed position.

      (1) Place air inlet end of ventilator in passenger convenience pod air cup. Align holes in ventilator mounting flange with nutplates behind convenience pod structure and secure ventilator with four screws.

      (2) Install convenience pod escutcheon trim (refer to Chapter 25, FURNISHINGS).

      (3) Perform Adjustment/Test of passenger convenience pod ventilator.

2. Adjustment/Test Passenger Convenience Pod Adjustable Air Inlet (Ventilator)

   A. Equipment Required - None.

   B. Perform Test of Adjustable Ventilator.

      (1) Operate air conditioning system or connect external air conditioning unit to airplane ground air conditioning connection.

      (2) With air supplied to system, open and close ventilator several times checking for erratic operation and/or excessive leakage in the closed position.

         NOTE: The ventilators shall open and close easily and smoothly and shall not cause rotation of the ball in the ball socket.

      (3) If ventilator operates erratically or leaks excessively in closed position, remove and replace with a like serviceable unit. There is no cleaning, lubrication or adjustment required on these units when installed in the airplane.

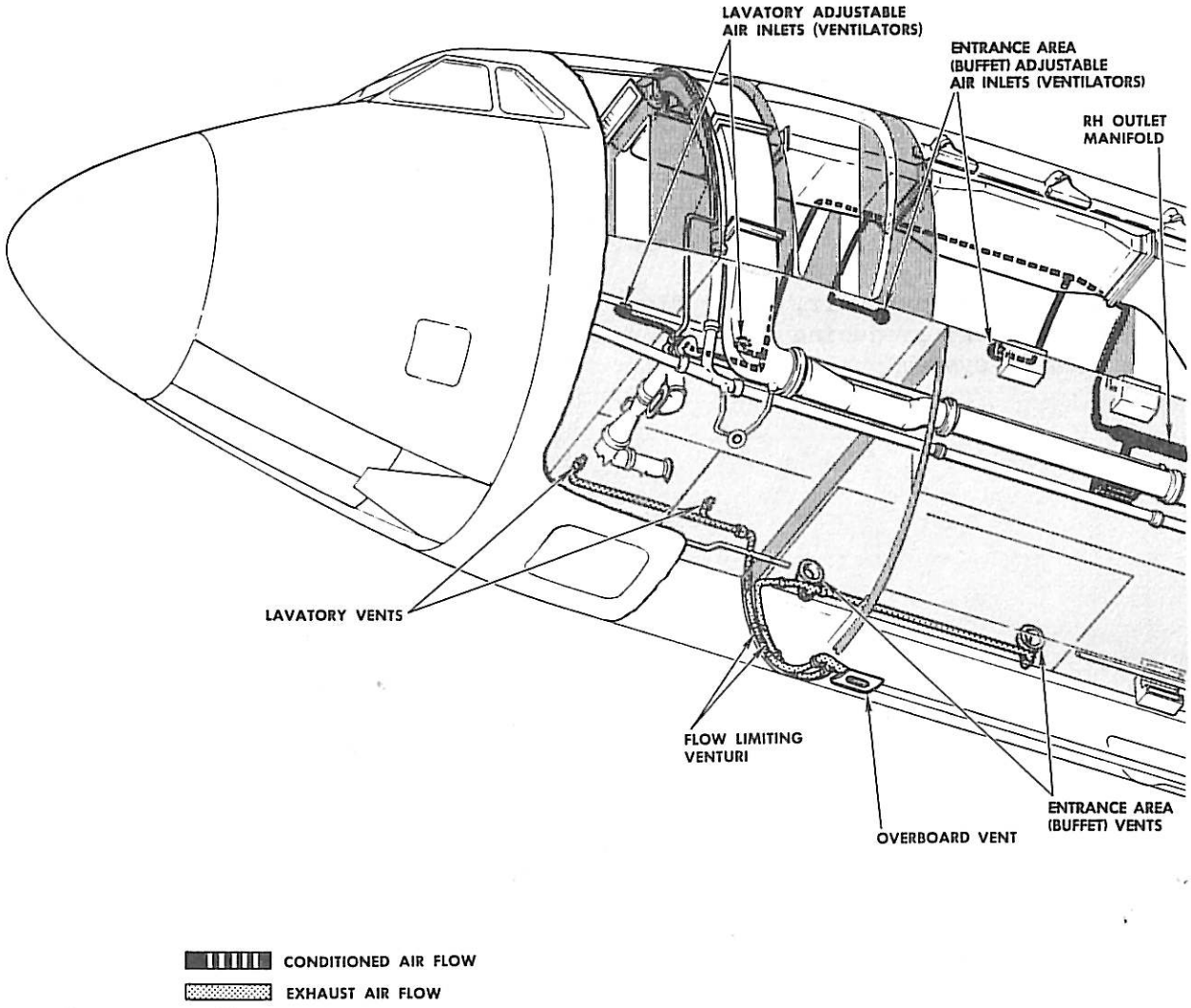
LAVATORY AND ENTRANCE AREA AIR DISTRIBUTION SYSTEM - DESCRIPTION AND OPERATION

1. Description

The lavatories and entrance areas are equipped with adjustable conditioned air inlets (ventilators) and overboard exhaust vents for ventilation (see Figure 1). The ventilators receive air from the air supply manifold in the passenger cabin. The forward area ventilators are connected by tubing to the forward right side air manifold at a point slightly aft of the sixth passenger window. The aft ventilators are connected to the aft right side manifold at a point just forward of the last passenger window.

The lavatory and entrance exhaust vents are connected to a system of tubing, venturis and overboard discharge ports which are independent of the normal ventilating system. The buffet vents connect to the overboard exhaust vents in the entrance areas. This method of ventilation prevents cooking or lavatory odors from entering the passenger cabin as all air from these areas is discharged directly overboard.

Lavatory exhaust air, as it flows through the venturi, performs another function by producing a vacuum source for the airplane's pressurization control system.



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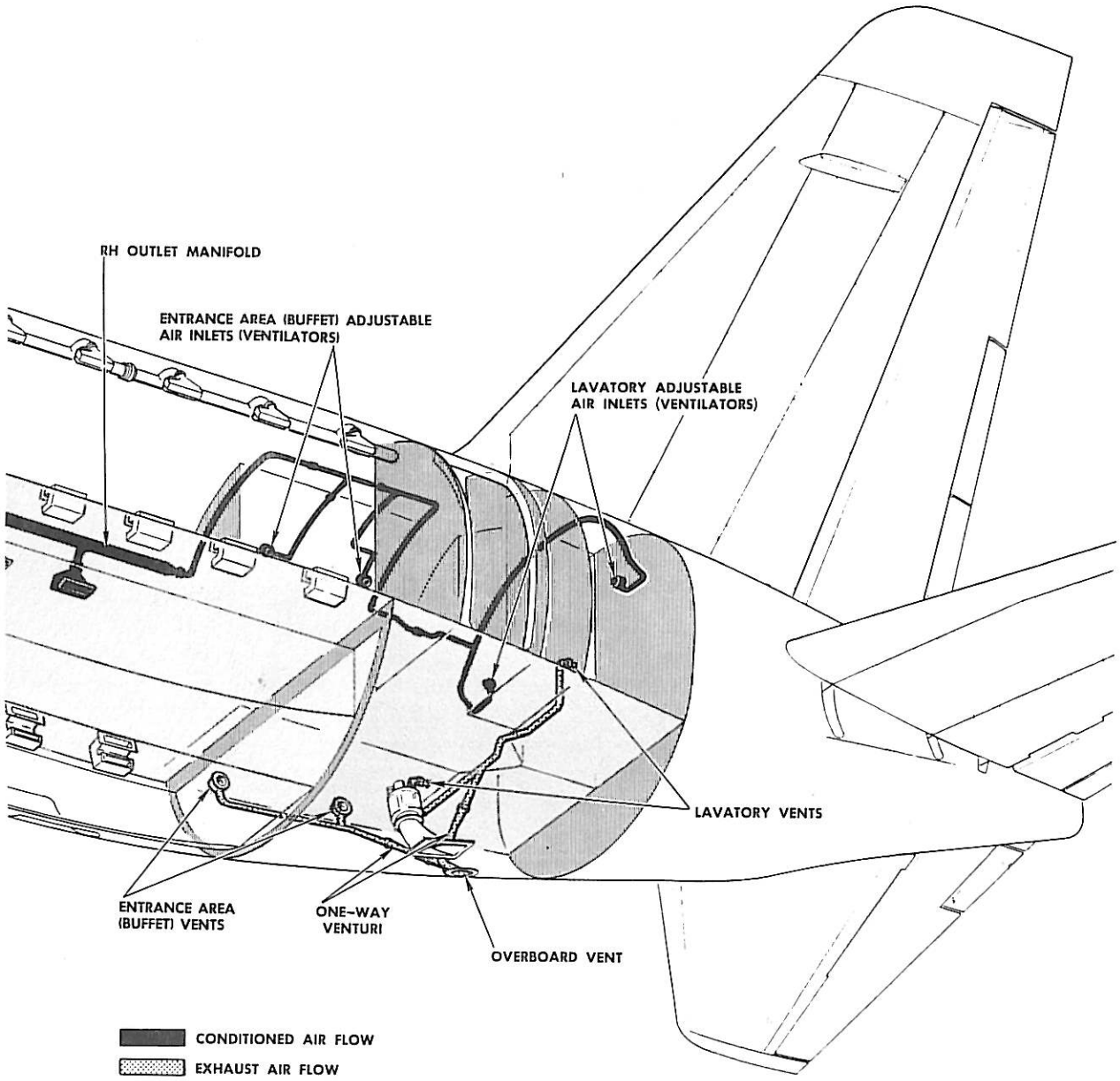
Lavatory and Entrance Area Air Distribution Ducts
Figure 1 (Sheet 1 of 2)



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Lavatory and Entrance Area Air Distribution Ducts
Figure 1 (Sheet 2 of 2)

LAVATORY AND ENTRANCE AREA AIR DISTRIBUTION SYSTEM - MAINTENANCE PRACTICES

1. Removal/Installation Lavatory and Entrance Area Adjustable Air Inlets (Ventilators) (see Figure 201)

   A. Equipment Required - None.

   B. Remove Lavatory and Entrance Area Ventilators.

      (1) Loosen small set screw securing ventilator trim cover to ventilator; unscrew trim cover from ventilator.

      (2) Remove four screws securing ventilator mounting flange to air cup structure behind trim panel; remove ventilator.

   C. Install Lavatory and Entrance Area Ventilators.

      NOTE: Prior to installing ventilator ascertain that spiral groove inside valve body is free of chips or foreign matter which may cause the ventilator to bind and/or not seal properly in the closed position.

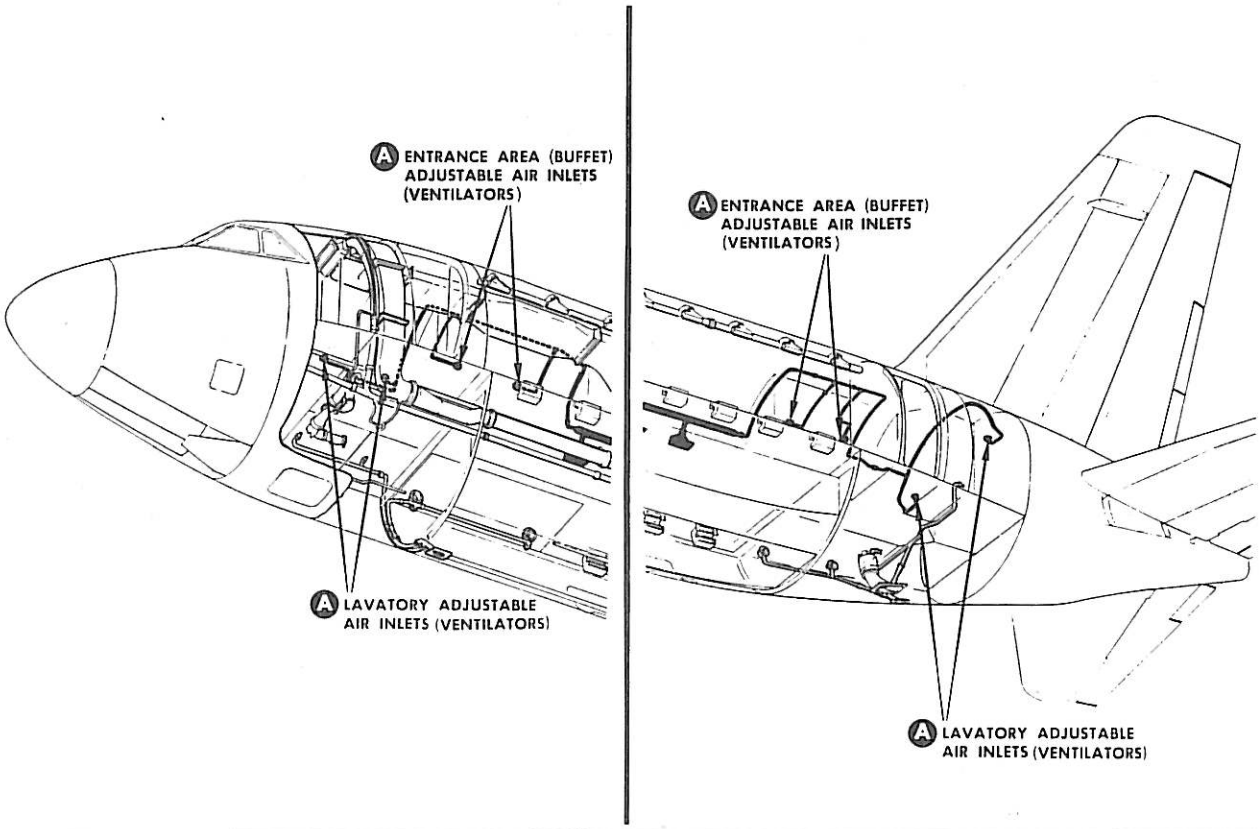
      (1) Place air inlet end of ventilator in air cup behind trim panel. Align holes in ventilator mounting flange with nutplates in air cup structure and secure ventilator to structure with four screws.

      (2) Screw threaded trim cover onto face of ventilator and secure cover with small set screw.

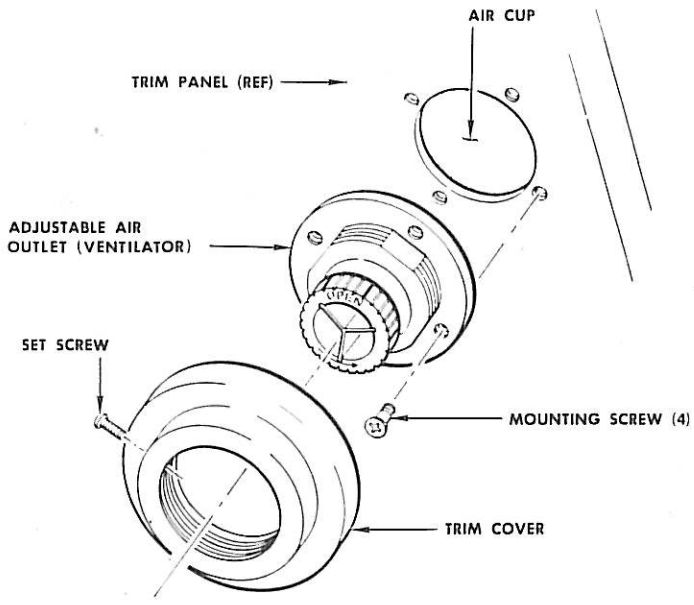
      (3) Perform Adjustment/Test of lavatory and entrance area ventilators.

2. Adjustment/Test Lavatory and Entrance Area Adjustable Air Inlets (Ventilators)

   For Adjustment/Test of the lavatory and entrance area ventilators, refer to 21-9-2, Maintenance Practices.



A



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Lavatory and Entrance Area Adjustable Air Inlets (Ventilators) Installation
Figure 201

ELECTRONIC EQUIPMENT COOLING SUBSYSTEM - DESCRIPTION AND OPERATION

1. General

The compact design of modern electronic equipment and the increased use of transistors have established the need for a positive flow of cooling air through the equipment. Cooling is necessary to maintain the electronic components and their circuit characteristics at their designed values. There are two methods of supplying the cooling air. In flight, when the airplane is pressurized, the flow of cooling air is provided by routing conditioned, pressurized air from the passenger compartment to the electronic and electrical compartments. After flowing through or around the components, the cooling air is then dumped overboard through the electronic equipment cooling valve or through the forward pressure regulating outflow valve. When the airplane is on the ground, or when not pressurized in flight, an electric fan provides the flow of cooling air.

Switches for control of the electronic equipment cooling fan and the electronic equipment cooling valve are located on the flight engineer's panel. A LOW AIR FLOW warning light adjacent to the switches indicates inadequate cooling. See Figures 1 and 2 for schematic illustrations of electronic equipment compartment cooling.

2. Electronic Equipment Cooling Fan

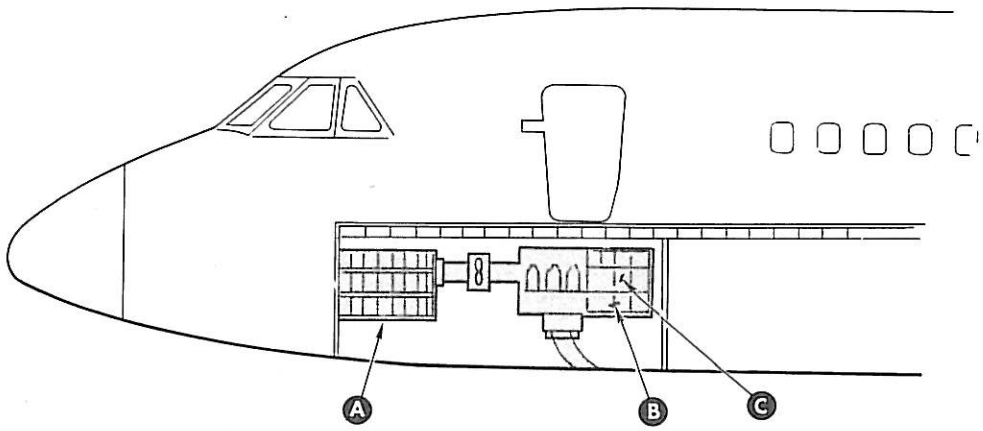
A. Description.

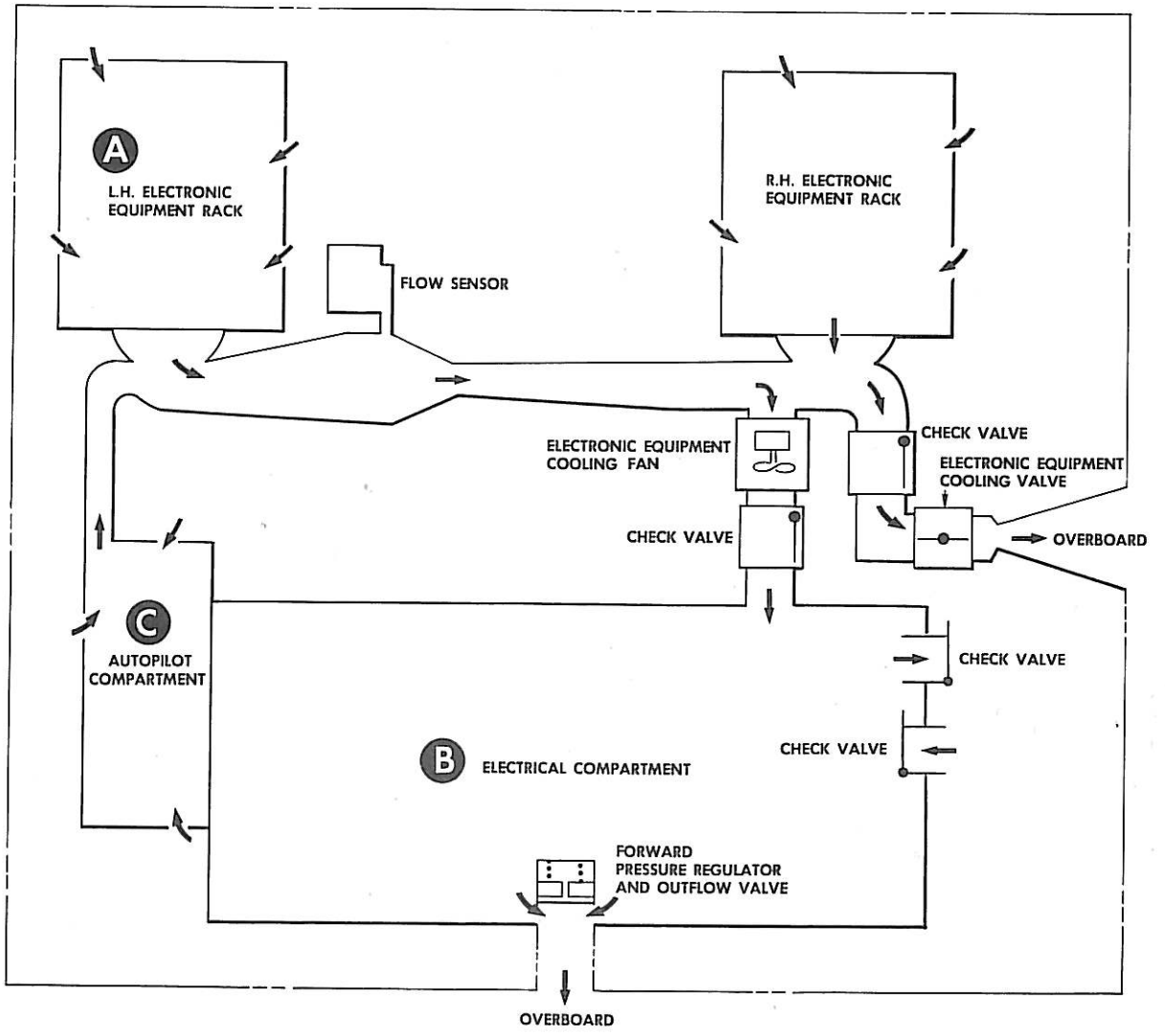
The electronic equipment cooling fan, shown on Figure 3, consists of a fan housing, the fan, and the fan motor. The fan housing consists of a 6.00 inch inside diameter duct section approximately 9.50 inches long. The fan and fan motor are installed inside of the fan housing. The fan motor is a 115/200-volt, 3-phase, 400 cycle ac motor incorporating automatic three phase thermal overload protection.

The fan capacity is 35 pounds per minute weight flow at 3.65 inches of water static pressure differential across the fan at sea level pressure and 130 degree F (54 degree C) inlet air temperature.

B. Operation.

The electronic equipment cooling fan has provisions for both automatic and manual operation. Automatic operation is controlled by the right hand landing gear ground safety relay No. 4. This relay turns the fan on at all times when the airplane is on the ground. During ground operation, both pressure regulating and outflow valves are in the full open position. Cooling air from the fan is exhausted overboard through the forward outflow valve. Manual operation is available through a switch on the flight engineer's panel. The switch should be placed ON when the LOW AIR FLOW warning light is illuminated. If it should become necessary to depressurize the airplane in flight, or if the cabin pressure differential is too low for adequate cooling, the LOW AIR FLOW warning light will remind the flight engineer to operate the cooling fan and close the electronic equipment cooling valve.


A
B
C


A
L.H. ELECTRONIC EQUIPMENT RACK
R.H. ELECTRONIC EQUIPMENT RACK
FLOW SENSOR
ELECTRONIC EQUIPMENT COOLING FAN
CHECK VALVE
ELECTRONIC EQUIPMENT COOLING VALVE
CHECK VALVE
OVERBOARD
C
AUTOPILOT COMPARTMENT
CHECK VALVE
CHECK VALVE
B
ELECTRICAL COMPARTMENT
FORWARD PRESSURE REGULATOR AND OUTFLOW VALVE
OVERBOARD

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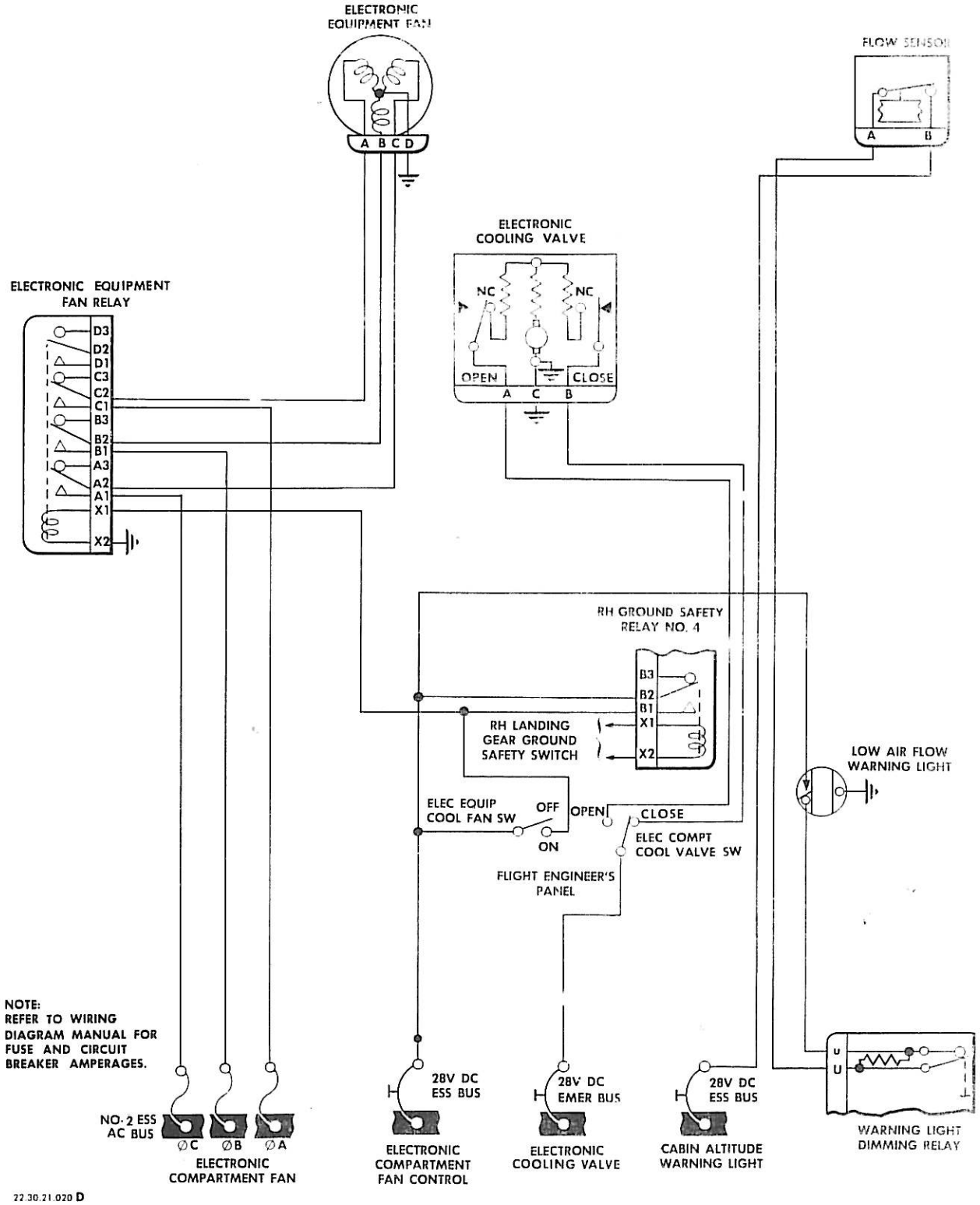

ELECTRONIC EQUIPMENT FAN
A B C D
FLOW SENSOR
A B
ELECTRONIC COOLING VALVE
NC
NC
OPEN
CLOSE
A C B
ELECTRONIC EQUIPMENT FAN RELAY
D3
D2
D1
C3
C2
C1
B3
B2
B1
A3
A2
A1
X1
X2
RH GROUND SAFETY RELAY NO. 4
B3
B2
B1
X1
X2
RH LANDING GEAR GROUND SAFETY SWITCH
LOW AIR FLOW WARNING LIGHT
ELEC EQUIP COOL FAN SW
OFF
ON
OPEN
CLOSE
ELEC COMPT COOL VALVE SW
FLIGHT ENGINEER'S PANEL
NOTE:
REFER TO WIRING DIAGRAM MANUAL FOR FUSE AND CIRCUIT BREAKER AMPERAGES.
NO. 2 ESS AC BUS
ØC ØB ØA
ELECTRONIC COMPARTMENT FAN
28V DC ESS BUS
ELECTRONIC COMPARTMENT FAN CONTROL
28V DC EMER BUS
ELECTRONIC COOLING VALVE
28V DC ESS BUS
CABIN ALTITUDE WARNING LIGHT
U U
WARNING LIGHT DIMMING RELAY
22.30.21.020 D

3. Cooling Air Flow Sensor

A. Description.

The cooling air flow sensor, shown on Figure 3, consists of a pressure switch mounted on a venturi-type duct. The pressure switch assembly is divided into two chambers by a diaphragm. A low pressure chamber on one side of the diaphragm is connected to a pressure tap at the venturi throat. A calibration screw and plate compress a calibration spring against the low pressure side of the diaphragm. A high pressure chamber on the other side of the diaphragm is connected to a pressure tap at the duct inlet. A limit switch is mounted in this chamber and contacts the diaphragm so that, at no airflow, the switch is closed.

B. Operation.

In operation, cooling air is routed through the venturi-type duct. Air pressure at the duct inlet acts on the high pressure side of the diaphragm, while air pressure at the duct throat acts on the low pressure side. Since air pressure at the duct throat is lower than inlet pressure, a pressure differential is formed across the diaphragm.

When inlet airflow conditions cause a pressure differential that is sufficient to move the diaphragm from the limit switch, the circuit is opened. A decrease in airflow (to below the circuit closing range) results in a decrease in pressure differential, causing the diaphragm to contact the limit switch and close the circuit. The circuit will remain closed while inlet airflow conditions are below the calibrated range.

4. Electronic Equipment Cooling Valve

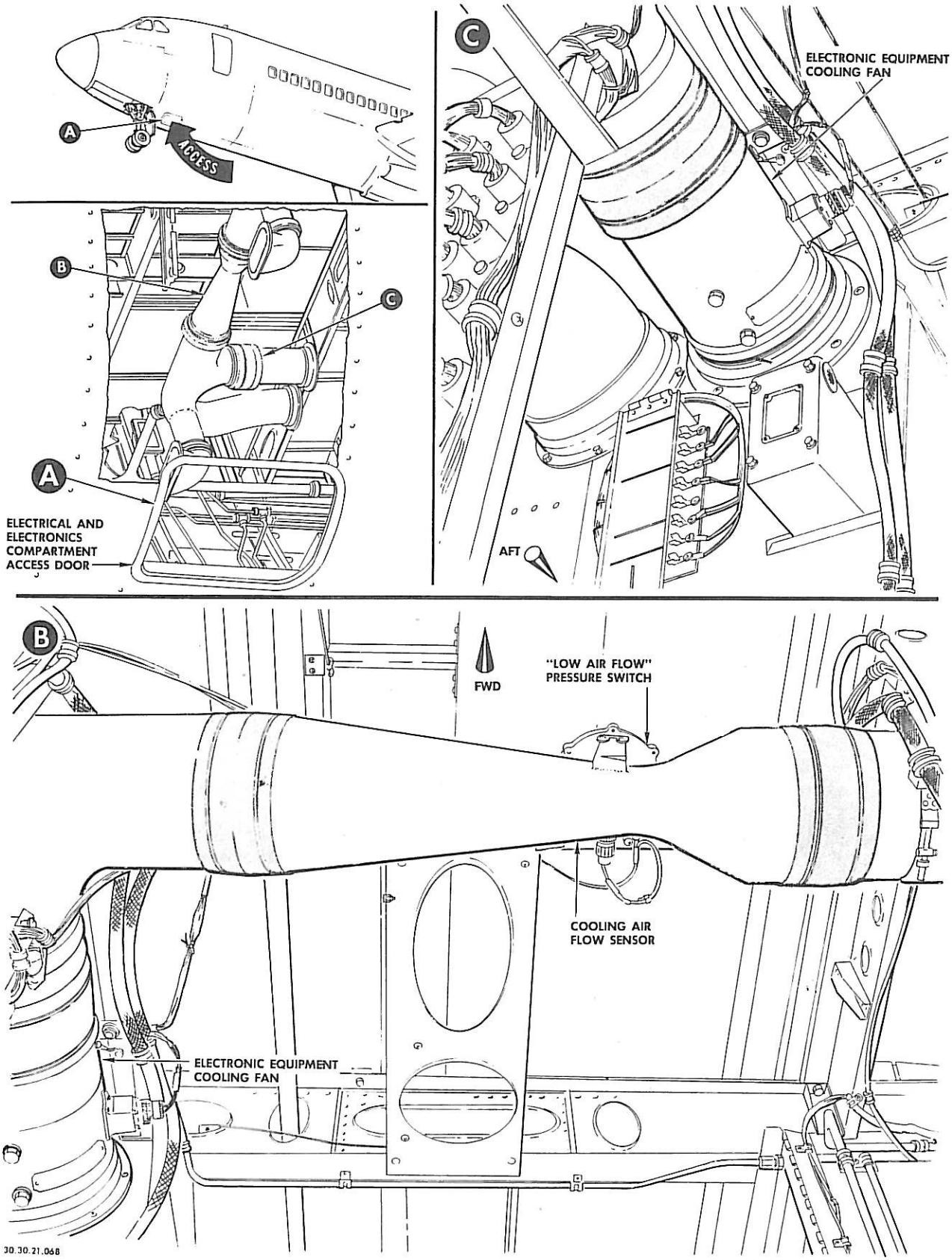
A. Description.

The electronic equipment cooling valve consists of a short duct section containing a butterfly valve, and an actuator housing containing a reversible 28-volt dc motor and two limit switches. The valve is installed on the right hand side of the electrical compartment.

B. Operation.

The cooling valve permits an additional flow of cooling air through the electrical compartment during normal operations. The valve also insures an adequate flow in the event the forward pressure regulating and outflow valve malfunctions in the closed position.

Airflow through the cooling valve is limited by a venturi downstream of the valve. Airflow is limited to maintain the proper outflow of air during pressurized flight periods. Normally, the valve is left in the open position except when it is necessary to maintain cabin pressure in an emergency or when the electronic equipment cooling fan is manually turned on, in which case the valve is closed.



Electronic Equipment Cooling Fan
and Airflow Sensor
Figure 3

The electronic equipment cooling valve is controlled by the ELECT COMPT COOLING VALVE switch on the flight engineer's panel. Placing the switch in the OPEN position will apply 28-volts dc to drive the actuator motor to the full open position. When the open position is reached, a limit switch within the actuator housing will interrupt the electrical power. Placing the control switch in the CLOSED position will, in a similar manner, apply power to drive the valve to the closed position. Another limit switch will interrupt power at the closed position. The electronic equipment cooling valve cannot be stopped in an intermediate position.

5. Electronic Equipment Cooling Ducts

A. Description.

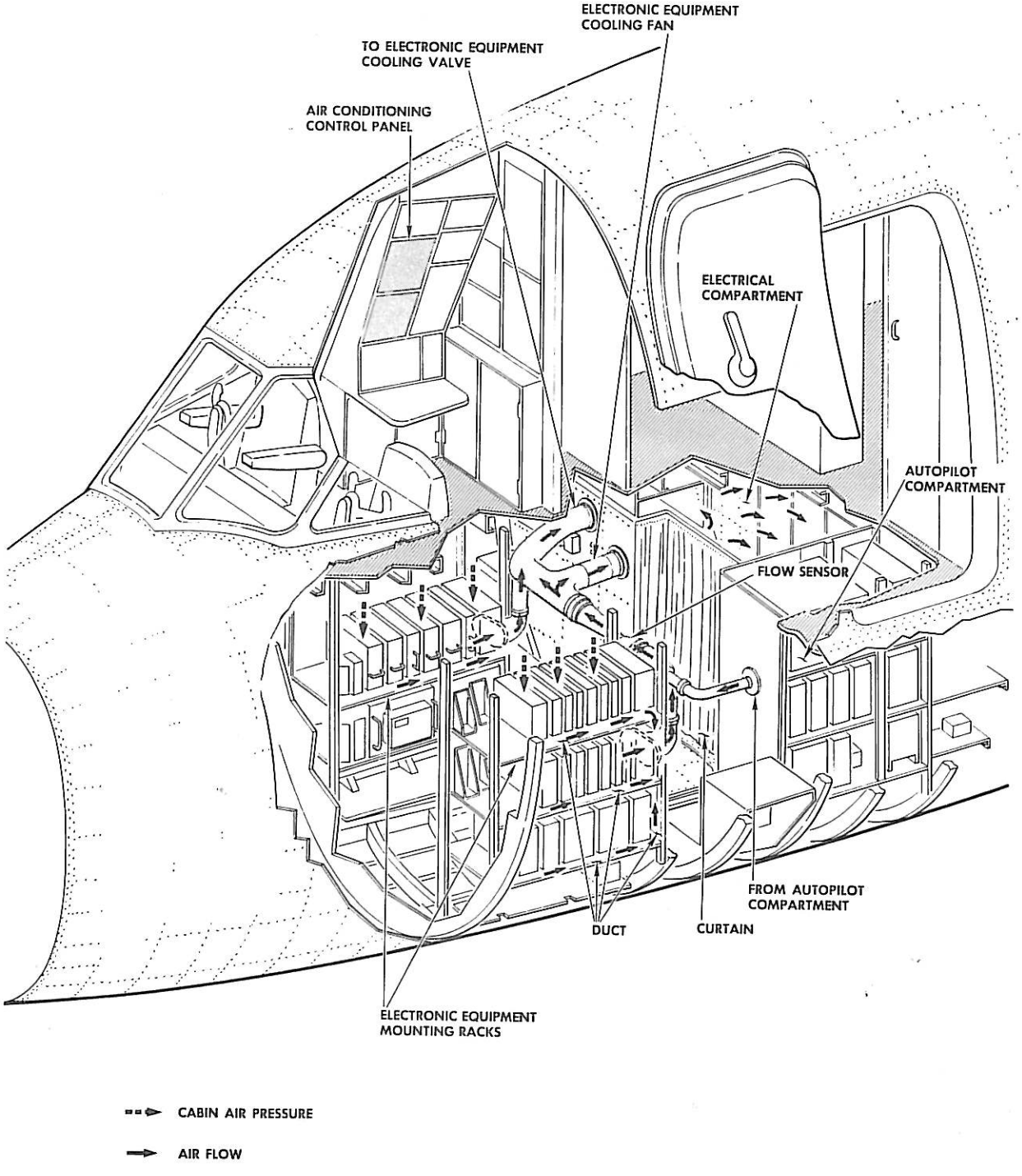
The electronic equipment cooling ducts (see Figure 4) are a series of ducts built into the electronic equipment mounting racks, and the connecting ducts which route the air through the cooling fan, the electrical compartment, and then overboard.

B. Operation.

Cooling air passes downward through each component on the electronic equipment racks. It then enters the ducts built into the racks, and is routed aft and up to the roof of the compartment. Cooling air exhausted from the left racks is routed through a flow sensor (venturi tube) to the right side of the compartment. It then passes through a check valve and is dumped overboard through the electronic equipment cooling valve. Cooling air exhausted from the right racks is routed aft through the mounting racks and up toward the roof of the compartment. It then passes through the same check valve and electronic equipment cooling valve to be dumped overboard. Air from the right electronic equipment cooling rack does not pass through the flow sensor.

The autopilot compartment is located on the left side of the electrical compartment. It is closed off from the electrical compartment and is a separate area. Autopilot components are cooled by the general circulation of air through the area. Air is not routed under pressure through the components. The cooling air moves forward through the compartment and is then ducted through the flow sensor where it follows the same path as air exhausted from the left electronic equipment racks.

In the electrical compartment two separate flow patterns are used. When the airplane is pressurized and the cooling fan is turned off, air enters the compartment through large flapper-type check valves mounted in the walls. It then cools the components by circulating through the compartment, and is dumped overboard through the electronic equipment cooling valve. If the cabin pressurization schedule requires it, or if the aft pressure regulating outflow valve should malfunction toward the


ELECTRONIC EQUIPMENT COOLING FAN
TO ELECTRONIC EQUIPMENT COOLING VALVE
AIR CONDITIONING CONTROL PANEL
ELECTRICAL COMPARTMENT
AUTOPILOT COMPARTMENT
FLOW SENSOR
FROM AUTOPILOT COMPARTMENT
DUCT
CURTAIN
ELECTRONIC EQUIPMENT MOUNTING RACKS
CABIN AIR PRESSURE
AIR FLOW

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closed position, additional air will be dumped overboard through the forward pressure regulating outflow valve. If necessary, the electrical compartment check valves and the forward pressure regulating outflow valve can handle the entire output of the pressurization system to maintain normal pressurization schedules. When the electronic equipment cooling fan is operating, it pulls air through both electronic equipment racks and the autopilot compartment, and forces the air into the electrical compartment. The air is then dumped overboard through the forward pressure regulating outflow valve.

ELECTRONIC EQUIPMENT COOLING SUBSYSTEM - TROUBLE SHOOTING

POSSIBLE CAUSES	ISOLATION PROCEDURE AND CORRECTION
1. ELECTRONIC EQUIPMENT COOLING FAN INOPERATIVE	
A. Faulty fuses or circuit breaker.	Check three 5 ampere E & E COMPT COOLING FAN MOTOR fuses in ac power distribution panel (flight engineer's station). Check ELEC COMPT FAN CONT circuit breaker on main circuit breaker panel.
B. Faulty cooling fan.	Remove electrical connector from fan. Place ELECT EQUIP COOL FAN switch ON. Check for 115 volts ac between terminal A and ground, terminal B and ground, and terminal C and ground. If proper voltages and the ground connections exist at connector, replace the cooling fan.
C. Faulty wiring or fan control relay.	If proper voltage does not exist at fan connector, check wiring from connector through fan control relay to fuses in ac power distribution panel.
2. NO AUTOMATIC OPERATION BY GROUND SAFETY RELAY (MANUAL OPERATION OK)	
A. Faulty ground safety relay operation.	Check operation of RH ground safety switch and RH ground safety relay No. 4 (refer to Chapter 32, LANDING GEAR). Check wiring from ELEC COMPT FAN CONT circuit breaker through RH ground safety relay No. 4 to the electronic compartment fan control relay.
3. NO MANUAL OPERATION (AUTOMATIC OPERATION BY GROUND SAFETY RELAY OK)	
A. Faulty electronic compartment cooling fan switch, or faulty wiring.	Remove the RH ground safety relay No. 4 from socket and check for continuity from the ELEC COMPT FAN CONT circuit breaker through the fan control switch to the fan relay.
4. LOW AIR FLOW WARNING LIGHT INOPERATIVE	
A. Faulty warning light bulb or circuit breaker.	Test bulb and check CABIN ALT WARN circuit breaker.

POSSIBLE CAUSES	ISOLATION PROCEDURE AND CORRECTION
4. LOW AIR FLOW WARNING LIGHT INOPERATIVE (CONT)	
B. Faulty wiring.	Check wiring from CABIN ALT WARN circuit breaker through flow sensor and dimming relay to the LOW AIR FLOW warning light.
C. Faulty flow sensor.	With no cooling air flow, check for continuity between pins A and B of the flow sensor. If no continuity replace flow sensor.
5. LOW AIR FLOW WARNING LIGHT REMAINS ON	
A. Faulty flow sensor.	If air flow appears normal, replace flow sensor. Visually check ducts for obstruction.

ELECTRONIC EQUIPMENT COOLING FAN - MAINTENANCE PRACTICES

1. Removal/Installation Electronic Equipment Cooling Fan

   A. Equipment Required - None.

   B. Preparation.

      (1) Open ELEC COMPT FAN CONT circuit breaker.

      CAUTION: IN STEP (2), DO NOT OPEN THE AC POWER DISTRIBUTION PANEL WITH THE BATTERY ON, THE ENGINES RUNNING, OR WITH EXTERNAL POWER CONNECTED TO THE AIRPLANE.

      (2) Remove three E & E COMPT COOLING FAN MOTOR fuses from ac power distribution panel.

      (3) Open electrical and electronic compartment door.

   C. Remove Electronic Equipment Cooling Fan.

      (1) Locate fan mounted near roof of compartment slightly to the right of the airplane centerline and slightly aft of the door. The fan housing forms a duct section running aft from the electronic equipment racks to the forward right hand bulkhead of the electrical compartment.

      (2) Remove wire securing ducts to forward and aft end of fan housing.

      (3) Disconnect electrical connector from fan. (Cap connector and receptacle. Tag for installation.)

      (4) Disconnect grounding wire from fan.

      (5) While supporting fan, remove four bolts securing fan to overhead structure.

      (6) Remove electronic equipment cooling fan.

   D. Install Electronic Equipment Cooling Fan.

      (1) Position fan between duct openings with direction-of-flow arrow pointing aft.

      (2) Install four mounting bolts to secure fan to overhead structure.

      (3) Connect grounding wire to fan.

      (4) Connect electrical connector to fan receptacle.

      (5) Secure ducts at forward and aft ends of fan housing with wire.

(6) Install three five ampere E & E COMPT COOLING FAN MOTOR fuses in the ac power distribution panel.

(7) Remove warning tag and close ELEC COMPT FAN CONT circuit breaker.

(8) Operate fan and feel for air discharged from aft end.

(9) Perform Adjustment/Test of fan.

2. Adjustment/Test Electronic Equipment Cooling Fan

A. Equipment Required - External source of 115/200-volt, 3-phase, 400 cycle ac electrical power (refer to Chapter 24, ELECTRICAL POWER).

B. Preparation.

CAUTION: IN STEP (1) FOLLOWING, DO NOT OPEN THE AC POWER DISTRIBUTION PANEL WITH THE BATTERY ON, THE ENGINES RUNNING, OR WITH EXTERNAL POWER CONNECTED TO THE AIRPLANE.

(1) Ascertain that three 5A ELEC COMPT BLOWER fuses are installed in the ac power distribution box.

(2) Connect external source of electrical power to airplane (refer to Chapter 24, ELECTRICAL POWER).

(3) Check that RH landing gear ground safety relay is in "ground" position.

(4) Close CABIN ALT WARN and RH LDG GEAR GRD SAFETY SW circuit breakers.

NOTE: When the CABIN ALT WARN circuit breaker is closed, the LOW AIR FLOW warning light on the flight engineer's air conditioning and pressurization control panel shall illuminate.

C. Test Electronic Equipment Cooling Fan.

(1) Close ELEC COMPT FAN CONT circuit breaker and note the following:

(a) Electronic equipment cooling fan shall start.

(b) LOW AIR FLOW warning light shall extinguish.

NOTE: With the airplane in the "groundborne" configuration the fan shall operate with the ELECT EQUIP COOL FAN switch in either the ON or OFF position.

(2) Place ELEC EQUIP COOL FAN switch in OFF position.

WARNING: PRIOR TO PERFORMING STEP (3), ASCERTAIN THAT ANTISKID SYSTEM IS TURNED OFF AND/OR THE MAIN WHEELS ARE PROPERLY CHOCKED.

(3) Place RH landing gear ground safety relay in "airborne" position and note the following:

(a) Electronic equipment cooling fan shall stop.

(b) LOW AIR FLOW warning light shall illuminate.

(4) Place ELEC EQUIP COOL FAN switch in ON position.

(a) Electronic equipment cooling fan shall start.

(b) LOW AIR FLOW warning light shall extinguish.

(5) Place ELEC EQUIP COOL FAN switch in OFF position.

(a) Electronic equipment cooling fan shall stop.

(b) LOW AIR FLOW warning light shall illuminate.

(6) Open CABIN ALT WARN circuit breaker; the LOW AIR FLOW warning light shall extinguish.

(7) When test is satisfactory, remove external electrical power and restore airplane to normal configuration.

COOLING AIR FLOW SENSOR - MAINTENANCE PRACTICES

1. Removal/Installation Cooling Air Flow Sensor (refer to 21-10-0, Figure 3)

   A. Equipment Required - None.

   B. Preparation.

      (1) Open CABIN ALT WARN circuit breaker.

      (2) Open electrical and electronic compartment access door.

   C. Remove Cooling Air Flow Sensor.

      (1) Locate the cooling air flow sensor. It is a venturi shaped duct section with a pressure switch mounted on top. The flow sensor runs across the compartment near the roof, and directly over the aft edge of the door.

      (2) Disconnect electrical connector from aft end of pressure switch. (Cap connector and receptacle. Tag connector for installation.)

      (3) Disconnect grounding wire attached to overhead structure and air flow sensor.

      (4) Remove wire securing each end of flow sensor to adjoining duct.

      (5) Remove cooling air flow sensor.

   D. Install Cooling Air Flow Sensor.

      (1) With electrical receptacle on top and pointing aft, position flow sensor between duct openings.

      (2) Position connecting hose on each end of flow sensor. Secure in place with two turns of wire. Twist approximately one inch of the wire ends together to secure in place.

      (3) Connect grounding wire to overhead structure.

      (4) Connect electrical connector to pressure switch on flow sensor.

      (5) Close electrical and electronic equipment compartment door.

      (6) Close CABIN ALT WARN circuit breaker.

      (7) Test operation of fan and airflow sensor (refer to 21-10-1, Maintenance Practices).